Common Shells of the Sea Shore.

Rev. J. G. Wood.

No. 18
Robert G. Hinsdale.
"BENE ORASSE EST BENE STUDUISSE."

PLATE I.

THE

COMMON SHELLS

OF THE

SEA-SHORE.

BY THE

REV. J. G. WOOD, M.A., F.L.S.

AUTHOR OF THE "ILLUSTRATED NATURAL HISTORY,"
"COMMON OBJECTS OF THE SEA-SHORE," "MY FEATHERED FRIENDS,"
&c., &c.

WITH ILLUSTRATIONS BY G. B. SOWERBY.

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PREFACE.

THERE are many amusements for the wanderer by the sea-shore, and one of the most popular recreations is the search after Shells, whether their empty valves are picked up from the shore, or whether they are sought in a living state, so that the animal can be examined as well as the wondrous home in which it lives.

None but those who have given a little time to shell-hunting, can conceive the multitude of species which are discovered when practice has sharpened the eyes. But although it is comparatively easy to find shells, it is not so easy to identify them; and to gather together a quantity of shells which cannot be named, and about which the collector knows nothing, is an unprofitable and uninteresting task. Therefore it often happens that the once-zealous shell-hunter gradually flags in his labours, and at last ceases from them altogether, for lack of a simple and easily understood guide to the subject. This want I have endeavoured to supply, remembering my own feelings when I first began to wander about the sea-shore. Here is a little work which may be carried in the pocket, ready for immediate reference; the crabbed scientific words have been replaced by their corresponding English synonyms; and the book is so copiously illustrated, that it is impossible to find a shell which cannot be identified by reference to the engravings.

All the shells which are commonly picked up on the beach, or can be gathered at low-water, are figured; and in case the reader may be disposed—as I trust he may be—to pursue his researches further by means of the dredge, the trawl, or the drag, figures are given of all those shells which he is sure to find, and of nearly all those which he is likely to find. In order to assist the student still further, separate figures are given of the distinguishing marks by which one group of shells is known from another; and wherever any remarkable but minute characteristics exist, whether in the shell or the animal, they are drawn on a magnified scale.

Another advantage is, that the student is taught where to find the various species that are described. If he will look at

the twelve Plates, and compare with them the printed description, he will see at a glance the scientific name of the shell, together with the locality in which it is found.

Knowing that many persons have been discouraged at the very outset, by reason of the crabbed and often barbarous names by which the various species are known in the scientific world, I have given their popular titles whenever they exist, and when that is not the case I have supplied them, as has been done by entomologists with the multitudinous moths and butterflies of England. Whenever the name has been one easily remembered, and one that already exists, such as Venus, Astarte, Leda, and so forth, I have retained it; but when we come to such names as Scrobicularia, Chemnitzia, Terebratula, Xylophaga, etc., I have substituted for them certain English names which express some characteristic of the shell or its inhabitant, and in many cases have simply translated the Greek and Latin words into our own language.

The reader perhaps may be surprised, on looking over the list of Plates, to see that some of the shells are marked as inhabitants of fresh water, and a few of the land. But, on perusing the work, he will see that a slight mention of such shells is useful in order to preserve the necessary gradation from one group to another. Indeed, there are many shells that cannot be classed either as inhabitants of the fresh or salt water, because they seem to thrive indifferently in either the one or the other.

Let me strongly recommend the intending shell-hunter to read through the work *before* he begins his task, and then to set to work systematically. Let him give one day, for example, to the sands, another to the rocks, another to the sea-weeds which grow between high and low water, another to mud, and so forth. Let him always, if possible, procure the living animal with the shell, and keep it for a time in sea-water, so as to watch its habits; always taking care to make notes *in ink*, and to sketch anything that may strike the eye. Four or five weeks thus spent will impart a vast fund of knowledge; and when the shell-hunter returns home, he may go with profit and pleasure to those elaborate scientific works which would only have repelled him before. To such works this little book will act as a guide; and I cannot do better than recommend the four beautiful volumes of Messrs. Forbes and Hanley, whose arrangement I have followed throughout, and in which will be found a mass of information which is necessarily excluded from so small a work as the present.

THE

COMMON SHELLS

OF

THE SEA-SHORE.

CHAPTER I.

INTRODUCTION—SEMI-MOLLUSCS—THE TUNICATES—WHY SO CALLED—GENERAL STRUCTURE OF THE TUNICATES—ASCIDIANS—THEIR APPEARANCE AND LOCALITY—THE BOTRYLLUS, AND ITS STRUCTURE—WHERE IT IS TO BE FOUND—THE PEROPHORA, ITS GENERAL APPEARANCE—THE ASCIDIADÆ, OR SEA-SQUIRTS: WHY SO CALLED—CURIOUS IDEAS OF THE SAILORS—PRACTICAL JOKES—THE SIPHONS—ANATOMICAL STRUCTURE OF AN ASCIDIAN—HOW TO DISSECT THE ANIMALS—EGGS AND BUDS—THE CYNTHIA, ITS APPEARANCE AND LOCALITY—ASCIDIA MENTULA, THE LARGEST KNOWN SPECIES; ITS SHAPE AND SIZE—THE PELONEA—ORIGIN OF ITS NAME—HABITS OF THE PELONEA—MODIFICATION OF STRUCTURE—ZOOLOGICAL VALUE OF THE PELONEA.

ALTHOUGH this work is entitled "The Common Shells of the Sea-Shore," it necessarily embraces several species of molluscs which do not secrete shells at all, and which are clothed simply by their membrane, or by a tough, leathery envelope. These animals must be introduced, because a knowledge of their structure is needed, in order that the shell-making molluscs may be properly understood; but they will only be mentioned for that purpose, and any description of them will be curtailed as far as possible. We will begin at the beginning.

There is a large group of molluscs which are appropriately called TUNICATA, because their bodies are wrapped in a tunic, or envelope, instead of being protected by a shell. This tunic has always an inlet and an outlet,

sometimes at one end of the body, and sometimes one at each end. They are not pretty, and they are not conspicuous; but they occur in great profusion, so that everyone who has used a trawl or a dredge, or has examined the shore at low-water, must have had his attention drawn towards them. Many species inhabit our coasts, and one or two of the most plentiful are figured in the illustration.

They have no head, and no limbs, and, as is often the case with marine animals, they pass through a kind of metamorphosis, so that their lowest form is as unlike their perfect shape as the caterpillar is unlike the butterfly. Sometimes they are separate animals, and sometimes they are attached to each other; while there are instances, such as the *Salpœ*, where they are single and combined in alternate generations.

The first example on our list is a creature well known to zoologists, and not unfamiliar to the seaside wanderer, provided that the latter can make use of his hands and eyes. Adhering to the heavy masses of sea-weed, fixed to stones and empty shells, or spread over the interior of rocky holes, may be seen certain gelatinous masses that are called by various popular names, such as sponges and sea-jellies. They are of various sizes and various colours. Some project boldly like sea-anemones, some are spread upon the supporting substance like jelly, and others are formed into regular patterns, mostly of a star or leaf shape. Some are olive green, some are orange, some yellow, and some of a bluish hue.

These curious objects belong to the great group of Tunicata, and are called Ascidians, from the Greek word *Ascos*, which signifies a pouch made of skin. They furthermore belong to that family of the group which is called Botryllidæ, or Grape-animals, because they consist of a number of individuals connected together like grapes upon a bunch.

Of these, one of the best known and most typical

examples is that which is given in the illustration (Plate I., fig. 1), and it is technically named *Botryllus polycyclus*. Both of these terms are of Greek origin, and are peculiarly appropriate; the first signifying a bunch of grapes, and the other being formed of two words which signify "many-circled."

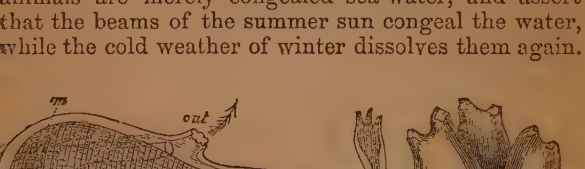
This species is easily recognisable by its form, although it varies in colour, being sometimes blue and sometimes purple. As may be seen by reference to the illustration, the individuals are united by a jelly-like substance, which forms a thin, semi-transparent crust upon the sea-weed or other object on which it rests. These beautiful star-like objects are common on nearly every part of our coast, and may generally be found on the great tangle-weeds, over the fronds of which they form masses of several inches in diameter.

At fig. 3 of the same plate is drawn another species, in order to show a different method of uniting the individuals. In the previous species the individuals are set upon a common gelatinous incrustation, but in the PEROPHORA they are at some distance from each other, and united by a delicate thread, which is, in fact, a modification of the "tunic" common to all the individuals. Though a very small species, it is rather pretty, the individuals being transparent as jelly, and dotted with orange and brown, and the uniting thread being pure lustrous white. Delicate as is this thread, the blood circulates through it, so that the nourishment which is taken by any individual is equally beneficial to the whole community.

When taken, they should be at once placed in a shallow vessel of sea-water, and left in perfect quietude for some little time, in order that the systematic contraction and extension of the central orifice may be noted.

We now come to a more advanced and more interesting group of these semi-molluscs, called the ASCIDIADÆ. Their name is very appropriate, for they look

exactly like the skin-bottles which are so common in Eastern countries. They are very prevalent in the mouths of rivers, especially if the ground be muddy, and are sometimes so plentiful as to become a serious annoyance to the professional fisherman. When trawling in the Medway and Thames, I have often known the net to be so filled with these curious creatures that it could not be lifted out of the water, and the sailors were obliged to hang over the side of the vessel and throw out the unwelcome guests, before they could bring the pocket of the trawl on board. They look wonderfully like white hothouse grapes, being partly transparent and of a very similar colour to the fruit. The fishermen have an odd notion that these animals are merely congealed sea-water, and assert that the beams of the summer sun congeal the water, while the cold weather of winter dissolves them again.



They exist in large masses, a vast number of individuals being grouped together; and when handled, they eject so violently the water with which they are filled, that they have well earned the name of Sea-squirts. I have often seen a novice in such matters drenched in a moment, by inadvertently taking up a mass of these animals which had been purposely laid in his way. In order that their structure may be known, an illustration is given explanatory of their formation.

In Cut 1 are three figures, which will explain the particular conformation of these remarkable creatures. At fig. 3 are shown three perfect individuals, as they

appear when fastened to a stone or shell. They are bag-like in form, and have two very distinct apertures, called "siphons," through the upper of which the water continually passes into the interior, and through the lower of which the same water is ejected, having been deprived of its nutritious particles in its passage through the animal.

Ordinarily, the flow of water is steady and moderate, but when the animal is irritated, it contracts itself so violently that the water is spirted out to a considerable distance, as out of a syringe.

At fig. 1 is seen the mechanism by which this act is performed. Surrounding the entire animal is a soft and membranous skin, called the "test," which is in many cases covered with the smaller algæ and marine animals. If this be cut open and turned back, a second skin, or inner tunic, is seen. This is formed chiefly of muscular fibres, laid in different directions, but being more closely gathered, and therefore more powerful, near the orifice. The best plan of separating these two skins is to place the animal for some little time in spirits, when the inner tunic contracts so violently that it separates itself from the outer envelope, and saves the trouble of careful dissection. Within is a third and very delicate tunic, which belongs to the respiratory system.

We now come to the digestive organs. Though the water enters the animal at the aperture which has already been mentioned, it does not reach the true mouth until it flows as far as the spot marked *m*, when it passes into the stomach, thence into the intestines, and thence into the surrounding water through the second orifice. If one of these animals be held to the light, the shape of the digestive apparatus can be easily traced by its dark opacity, contrasting with the partial translucence of the rest of the animal; and as the two upper tunics can be stripped off just like a grape-skin, it is easy to see the general outlines of the structure.

On one occasion, while engaged in trawling, I had quite an argument with the sailors, they asserting that the sea-grape was only congealed water, and I trying to persuade them of its real character. Finding argument to be useless, I took up one of the grape-like animals, and began to dissect it, telling them beforehand what they would see, and explaining the structure as layer after layer was opened. The men were utterly astounded, and could not get over their surprise for the rest of the day, referring to the subject continually, and having sustained a severe shock in self-esteem.

As is the case with many marine animals, the young are produced from eggs, but when hatched are as unlike their parents as a caterpillar is unlike a butterfly. They very much resemble the tadpole of the frog in shape, and are therefore said to be in the tadpole form. One of these "tadpoles" is shown at fig. 2, as it appears when magnified. When in the tadpole state of existence, it swims freely through the water by means of its long tail; and in order to enable it to direct its course, it is furnished with eyes, which, although minute, are sufficient for their purpose. When, however, it has completed its larval existence, it fastens itself to the substance on which it will ever afterwards rest, the long tail is quickly absorbed, and in process of time it assumes the perfect shape, as seen at fig. 3.

Besides this method of multiplying by means of eggs, the Ascidians also multiply by means of buds, which are pushed out from the parent being, and soon assume similar form and dimensions. A number of incipient buds are seen at the base of fig. 3.

The name of the species which has been figured is *Cynthia aggregata*.

In Plate I., fig. 5, is a group of Ascidians belonging to the typical genus. This species is called *Ascidia mentula*, and is perhaps the most plentiful of the British species. It is mostly found at a depth of

sixty or seventy feet, and sometimes grows to an enormous size, the individuals being as large as jargonelle pears. The outer tunic is peculiarly stout, and almost gristly in texture, and its colour is exceedingly variable, taking every intermediate shade from green to brown, sometimes being quite dark, and sometimes so pale that scarcely any colour is to be seen. In this genus, the aperture at which the water enters—and which is therefore called the inferent orifice—is surrounded with eight little lobes; while the other, or efferent orifice, is six-lobed.

Immediately above this object is drawn a curious species of the same group. Its name is *Pelonæa corrugata*, and it is remarkable as much for its habits as its shape.

It is not fixed to any object, but is as motionless as if it were attached to a rock, and seems to pass a singularly unenjoyable existence. Yet it is doubtlessly happy in its own way, though that way is a very strange one. It lives imbedded in the mud, its whole body being sunk, and only the ends of the two apertures projecting into the water. In consequence of this habit, the orifices are not placed at a distance from each other, as in the species which we have already examined, but are set closely together, and at the very extremity of the body. The name Pelonæa is of Greek origin, and is very appropriate, inasmuch as it signifies a dweller in the mud.

There are several British species of Pelonæa, two of which, at least, inhabit the British shores. The present species is dark brown in colour, and has the lengthened body covered with wrinkles; whereas in the other species, *Pelonæa glabra*, the body is shorter in proportion, the colour is greenish yellow, and the surface is smooth and hairy. Zoologists set great value on this rather unsightly animal, as it forms a link of transition between the Tunicates and the more perfect Molluscs.

CHAPTER II.

THE MOLLUSCS PROPER—THE PHOLAS FAMILY—THE PIDDOCK—USES OF THE ANIMAL—GENERAL DESCRIPTION OF THE SHELL—ITS ROUGH SURFACE AND ITS APPARENT USE—PECULIAR "GAPING" FORM OF THE SHELL, AND ITS OBJECT—INTERIOR OF THE SHELL—THE MARK OF THE MANTLE AND MUSCLES—THE "ACCESSORY VALVES," AND THEIR SHAPE AND OBJECT—SIMILARITY OF STRUCTURE IN THE PHOLAS AND THE ASCIDIANS—METHOD OF BORING—VARIETY IN SIZE AND AVERAGE DIMENSIONS—COLOUR OF THE PIDDOCK SHELL—METHOD OF PROCURING LIVING SPECIMENS—VARIOUS SPECIES OF BRITISH PIDDOCKS, AND THEIR DISTINGUISHING PECULIARITIES—THE PHOLADIDEA—WHY SEPARATED FROM PHOLAS—ITS CURIOUS STRUCTURE; THE CUP AND THE FRINGE—PRESUMED OBJECT OF THE CUP—DELICACY AND FRAGILITY OF THE SHELL—CONSEQUENT DIFFICULTY IN PROCURING PERFECT SPECIMENS—AVERAGE SIZE OF THE SHELL—THE SHIP-WORMS—SIMILARITY BETWEEN THE PELONÆA AND THE SHIP-WORMS—THE SIPHONS AND THE PALLETS—VALUE OF THE PALLETS IN DETERMINING SPECIES—RAVAGES OF THE SHIP-WORM—ITS GENERAL STRUCTURE AND MODE OF BORING—ITS METAMORPHOSIS WHEN YOUNG—REMARKABLE SPECIMEN OF THE SHIP-WORM'S TUNNEL—THE WOOD-PIDDOCK.

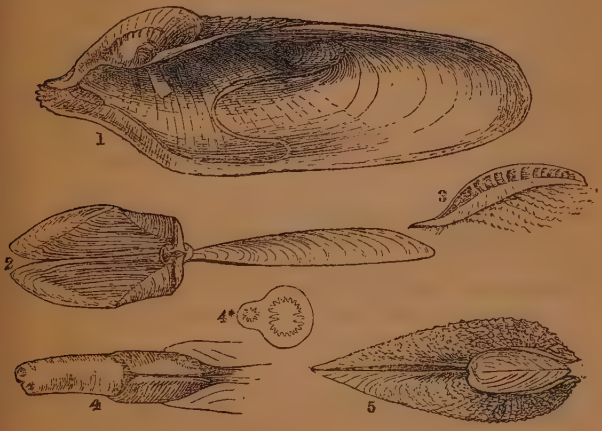
We now pass to the Molluscs proper, and begin with those which have some resemblance in structure to the Ascidians.

The first group in our list is that which includes the various species of Pholas, the boring-shells which are so plentiful upon our rocky or chalky shores, and which are popularly known among fishermen as Piddocks. As the shell is better known than the animal, it will be first described.

At Plate I., fig. 12, is shown the common Piddock (*Pholas dactylus*), as it appears in the hole which it has excavated. The shell is beautifully white, and its whole surface is covered with deep grooves, sweeping in a bold hexagonal curve, and crossing each other so as to make the outer surface into a shelly rasp. The shells gape slightly above, and rather more below,

the upper aperture affording a passage for the two siphons, or tubes, and the lower being intended for the muscular "foot" which projects between the shells, and by pressure against the wall of the burrow, forces the shell to perform the peculiar movements which insinuate it into the substance into which it is imbedded.

In the accompanying illustration, fig. 1, is shown the inner surface of the Piddock shell, in order to show its general structure and the points which are particularly worthy of notice. Towards the side of the shell are the "scars" which represent the marks of the muscles which draw the shell together; while the waved line towards the base of the shell shows the attachment of the mantle. This line will be hereafter described. If the shell be procured in a perfect state, some remarkable peculiarities of structure are to be seen.



Towards the base, and on the back, is a thickened portion of the shell, of a bridge-like form, and having a chambered structure, as is seen at fig. 3. There

are about eleven or twelve of these chambers, so that although light, the structure is very strong. Upon this "bridge" are placed certain "accessory valves," or plates of shell, to protect the base of the shell; and stretching along the back is a flat plate of the same substance, which guards the opening at the hinge. On the inside of the hinge is seen a curved projecting piece of shell, the use of which seems to be rather obscure. These accessory valves, and the flat piece that protects its back, are seen at fig. 2.

The reader will at once see that there is considerable similarity of structure between the animal of the Piddock and that of the Pelonea, which has just been described, the body being elongated, and the two siphons placed side by side at the extremity. In colour it is whitish, and the foot is nearly as transparent as if made of ice. Fishermen value this creature extremely, as it forms excellent bait, attracting the fish, and adhering firmly to the hook, which is passed through the foot.

The method by which the Piddock bores is now satisfactorily ascertained to be by a peculiar movement of the shell, not unlike that of a brad-awl when a carpenter is boring a hole in wood. The myriad tooth-like projections of the shell act like the teeth of a file, and by constant attrition work the shell into the rock. That they must become clogged by the particles which they cut away from the rock, is evident enough; and in order to free itself from these choking particles, the Piddock constantly deluges the burrow with water, washing out the greater part of the muddy sediment, and enabling the shell to perform its office effectually.

The common Piddock varies greatly in size, the largest being those which bore into soft substances, and the smallest those which inhabit hard limestone. The largest specimen that I have seen is in the possession of Mr. G. B. Sowerby, and is so large as to deserve the name of gigantic. It is found in various

substances, such as decayed wood, red sandstone, and chalk, the last-mentioned substance seeming to be its favourite. Although its natural hue is white, the Pholas is often stained with the colour of the substance in which it is imbedded; and when it lives in the red sandstone, the stain is often so deep that it might easily be taken for the natural colour of the shell.

In common with the rest of its kin, the Piddock has the power of evolving a phosphorescent light; and if the reader can manage to procure some living specimens, he will be most gratified by watching them in an aquarium. There is not the least use in procuring an elaborate glass aquarium for a visit to the sea-side. I always buy a flat earthenware pan, which answers every purpose, is very cheap, and can be left behind if the observer does not care to pursue the experiments in his own house.

To procure living specimens is not a very easy task, common as the creatures are. The simplest plan is to take a strong crowbar, prise up a large piece of rock into which the animals have bored, carry it above high-water mark, and then, with the aid of a mallet and cold chisel, chip out the inhabitants.

There are several species of British Piddocks, at least five being acknowledged. There is, for example, the White Piddock (*Pholas candida*), which has only one accessory valve. This species is shown in fig. 5, where the accessory valve is seen in its place. At fig. 4 are drawn the two siphons, or tubes, of another species, the Little Piddock (*Pholas parva*), in order to show the manner in which they project from the gaping end of the shell; and at fig. 4*, the same siphons are again seen, as they appear when viewed from the front. The observer who keeps these creatures alive should be careful to mark the flow of the water through the animal, entering at one siphon tube, and being ejected at the other.

The Little Piddock is, as its name implies, of small

dimensions. It is much shorter in proportion than the common species, seldom exceeding an inch and a half or two inches in length. It is, however, very stout in proportion. A very fine specimen now before me exhibits beautifully the single accessory valve, with its curious markings, as well as the interior hinge-projections, and the bold tooth-like projections of the shell, which are so close and so deeply waved towards the base of the shell, that they give peculiar richness of effect.

At Plate I., fig. 6, is represented a specimen of the Little Piddock, imbedded in the red chalk of Brighton.

The White Piddock has also a single accessory valve, which is broader and not so pointed as that of the preceding species. It is another of the small Piddocks, being about the same size as the Little Piddock, and is even more fragile than the generality of its fragile kin. All these shells require the most careful handling, for not only are the shells themselves delicate and brittle, but the accessory valves are so thin, so easily broken, and so slightly attached, that a rude grasp is sure to crush them, or at all events to break them away from their attachments. This species is comparatively active, readily taking alarm, and instantly retreating into the depths of its tunnel.

There is a genus of shells which are closely allied to the Piddocks, and which, in the opinion of several conchologists, really ought not to have been separated from them. This genus is called *Pholadidea*, and a figure of the shell and animal may be seen at Plate I. fig. 10.

The reader will at once note the remarkable cup-like appendage at the feet of the siphons, which affords the chief reason why the creature has been placed in a separate genus. The cup does not seem to discharge any particular office; but Messrs. Forbes and Hanley think that it is the germ of a supplementary tube, which, if elongated, would cover and protect the

siphons. The next point to be noticed is the extremity of the siphons, which are surrounded with a radiating appendage, something like the disc of a daisy, dandelion, or other composite flower.

The shell is peculiarly fragile, and so delicate, indeed, that it seems incapable of boring into the hard substances through which it makes its way. A specimen now before me is certainly not thicker than writing-paper, and scarcely so thick as that which is considered of the best quality. The cup still adheres to the end of the shell, which is deeply imbedded in hardened red clay. Removing the shell is a really difficult task, even for a practised hand, so delicate is its structure. It is a small species, rarely exceeding an inch and a half in length.

It is rather a remarkable fact that the shape of the shell alters considerably with age. When very young, the peculiar cup is not visible, and other portions of the shell are not fully formed. The reader will probably have remarked that the two siphon tubes are not separate, as is the case with the Piddocks, but that they are fused together, as it were, into a single tube, at the end of which the two orifices are situated.

To the same family as the Piddocks belong those wonderful and destructive molluscs popularly called Ship-worms. In spite, however, of their popular name, they are not worms at all, but are true shell-bearing molluscs, the shell being so small that for a long time it was mistaken for the jaws of the supposed worm.

At Plate I., fig. 13, is seen the typical species, *Teredo navalis*, as it appears while lying in its burrow, which is always made in wood. The shelly valves are seen at the bottom, while at the top the two siphons project. If the reader will compare this figure with that of the Piddock at fig. 12, he will at once see the resemblance between them, and that although in the Ship-worm the shell is very short and the body very

long, the creature is formed on precisely the same principle as the Piddock.

At the upper extremity, and just at the spot where the siphons begin to diverge from each other, are a pair of remarkable projections, technically named "pallets," which are of various shapes and sizes, according to the species which forms them. In the commonest British species, *Teredo norvagica*, they are of shell, and simple in their form, as may be seen in the accompanying illustration, fig. 5. In others they are of more elaborate structure, as, for example, in *Teredo bipennata*, where they are horny in texture, and shaped something like feathers, as may be seen at fig. 1, which represents a single valve of the shell and the pallets lying behind it. Fig. 2 represents the same portions of *Teredo palmulata*, in which the pallets

are still horny and closely feathered, but are short and rather variable in form. At fig. 3 are drawn the valve and pallets of another species, *Teredo malleolus*, in which the pallets are of shell, and shaped something like battledores. The general form of the shell is well seen at fig. 4, which shows the interior of the shell, so as to exhibit the curved process at the hinge and the method by which the two valves are united. This is the portion that was once mistaken for the jaws.

The Teredo is not very particular as to the kind of timber into which it bores, but always goes with the grain, unless it meets with some obstacle, such as a nail or a very hard knot; and in such a case it turns out of its track for a short distance, and then resumes its former course. As it bores its way along, it lines the tunnel with a coating of shelly matter, technically named "the tube," which has no connection whatever with the animal which makes it. When it is allowed to work undisturbed, as is the case with submerged piles and floating timber, it makes terrible ravages, gnawing away the wood, and rendering a huge mass of previously sound timber a mere mass of light shells, in which not an inch of uninjured wood can be found.

The tube is white, and very thin, though stronger than its thinness would seem to indicate. In the *Teredo norvagica* the tube is remarkable for a singular structure, which is shown at fig. 6. The tube is very long, narrow, and runs a somewhat winding course. The narrow end of it is divided into a number of compartments, by ten or twelve thin partitions which traverse it, but which do not form absolutely separate chambers, inasmuch as each partition has a tolerably large oval hole in the middle.

As is the case with the *Pholadidea*, the Teredo passes through several changes of form, and in its earlier stages is wholly unrecognisable by anyone except a practised naturalist. It is very minute, nearly sphe-

rical, and covered with cilia or hair-like projections, by means of which it swims rapidly through the water. In thirty-six hours it assumes a new form, and speedily changes it for another, after which it returns again to its original form, so that in a very few hours the little creature is first spherical, then oval, then triangular, and then spherical again. In this stage of existence it possesses a foot, which enables it to crawl, after the manner of snails, and also has organs of hearing and sight.

It does not enjoy its locomotive powers for any long time, but fixes itself to some suitable object, passes through its last change, becomes a veritable ship-worm, and begins its life-long task of boring. Opinions have long been divided on one point, namely, whether or not the ship-worm eats the material in which it bores. Many arguments have been used on both sides of the question; but there is now little doubt that the animal obtains the whole of its sustenance from the water which is perpetually driven through its body, and that it gains little or no nourishment from the wood into which it happens to burrow.

At fig. 7 is shown a remarkable example of a ship-worm's tube. In pushing forward its burrow, the ship-worm has accidentally cut its way into a hole whence a bolt has been extracted; and instead of merely filling up the aperture, it has extended its tube into the bolt-hole, producing the singular modification which is represented in the figure. This remarkable specimen is in the collection of Mr. G. B. Sowerby.

At page 14, figs. 8 and 9, are shown two specimens of an allied shell, called the Wood Piddock (*Xylophaga dorsalis*). Fig. 8 exhibits the closed shell, with the pair of accessory valves over the hinge; and fig. 9 depicts the living creature buried in wood, to show the manner in which it bores across the grain.

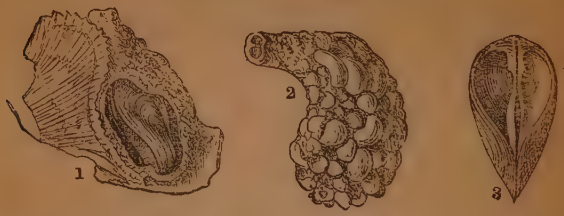
CHAPTER III.

BORING-SHELLS CONTINUED—THE GASTROCHÆNA, OR FLASK-SHELL—ORIGIN OF ITS NAME—FORM OF THE SHELL, AND ITS VARIABLE SHAPE—HABITS OF THE ANIMAL—ITS CURIOUS HOME—DOUBLE MOUTH OF THE FLASK—THE ROUGH STONE-BOREE, OR SAXICAVA—ORIGIN OF ITS NAME—BURROWS OF THE STONE-BOREE—CURIOUS ASPECT OF THE ROCK—A SUDDEN CHANGE—COLOURS OF THE ANIMAL—THE NORTHERN STONE-BOREE—DIFFICULTY OF DISTINGUISHING THE SPECIES—THE PETRICOLA, OR ROCK-SHELL—DIFFICULTY OF PROCURING IT—FOREIGN AND BRITISH SPECIMENS—THE IRUS SHELL, OR VENERUPIS—HABITAT OF THE ANIMAL—A CAUTION TO COLLECTORS—THE GAPER-SHELLS, AND THEIR GENERAL FORM—THE COMMON GAPER, OR OLD MAID—ITS STRUCTURE, HABITS, AND ENEMIES—THE SIPHON-TUBE, AND ITS FORM—HOW TO DISCOVER AND PROCURE THE GAPER-SHELLS—REMARKABLE FORMATION OF THE HINGE—THE BLUNT GAPER; FORM OF ITS SHELL—VALUE OF THE GAPER-SHELLS TO THE STUDENT OF CONCHOLOGY—THE BASKET-SHELL, OR CORBULA—ITS GENERAL STRUCTURE, AND FORM OF THE HINGE—THE NEÆRA SHELL; ITS REMARKABLE FORM—THE SIPHONS AND THEIR APPENDAGES.

We are still among the boring-shells, and begin with the remarkable creatures that are called by the name of Gastrochæna, because their shell gapes widely at the portion which is technically termed its belly.

At Plate I., figs. 11 and 9, may be seen two drawings of our commonest species, the Flask-shell (*Gastrochæna modiolina*), which, although it is extremely plentiful in certain localities, is not easy of procural. It generally lives at a depth of from twenty to sixty feet, and must be procured by the dredge or the drag, the former being preferable. The shell without the animal is by no means imposing or attractive. It is brown in colour, and small, rarely exceeding half an inch in length. A side view of the shell is seen at Plate I., fig. 9, and a back view at fig. 3 of the accompanying illustration. This latter figure is given in order to show the widely gaping form of the shell. The shape of the shell is by no

means uniform, varying in almost every individual; and even the two valves are dissimilar to each other, as is frequently the case with boring-shells.



We will now suppose that the reader has dredged up a quantity of the bed of the sea, in which have burrowed a number of the Gastrochæna. On examination of the mass, it will be found that the molluscs have not merely bored a hole, but that they have cemented together the sand, bits of shell, stone, and other materials, and have formed from them a curiously shaped tube. A very perfect specimen of one of these tubes is shown at fig. 2. It is flask-shaped, and has a very long neck, which is curved and divided into two portions, something like the proboscis of an elephant. The double tubes, however, are not quite distinct, but communicate with each other at their junction.

It is on account of the flask-like shape of the tube that the shell has derived its specific name of *modiolina*, the Latin word *modiolus* signifying a little flask. So perfect a specimen is, however, seldom found; and although the interior of the tube is always flask-shaped, its exterior is mostly irregular, so that its real character would not be recognised except by a practised eye. In a specimen now before me, for example, the tube is of nearly the same thickness throughout its entire length, and the extremity is, if anything, larger than the base, on account of a serpula tube which is attached to it.

An example of one of these irregular tubes is shown in fig. 1, in which is represented a specimen in Mr. Sowerby's collection. The animal has in this instance taken a fancy to a large piece of shell, and thus succeeded in disguising itself very effectually. Sometimes, when it settles down in a spot where oyster-shells have been thrown, it will bore completely through them, and attach itself to them in such a manner that the oyster-shell forms a kind of collar round the flask.

If the reader will now refer to Plate I., fig. 11, he will see why the tube is double. It is made for the reception of the double siphon, the two portions of which are united throughout their length, and have the extremities close to each other. They are not permanently extended, but are capable of being withdrawn almost wholly into the shell, a movement which generally takes place when the animal is alarmed. The shell is extremely frail, so that to take it out of its tube unharmed is not always easy. It is a very common species in the Mediterranean, as well as in the British localities which it chooses. It is, however, extremely local, and chiefly affects the southern coasts, especially those off Devonshire.

Close to the Flask-shell, and rather above it, is delineated another boring-shell, which is appropriately called the Rough Stone-borer (*Saxicava rugosa*), because it excavates rocks, and the shell is covered with wrinkles.

In this animal the siphons are comparatively short, and the general shape of the shell is not unlike that of the last-mentioned species. The Saxicava mostly attacks limestone, though it does not bore to a very great depth, its tunnel rarely exceeding six inches in depth. It is so plentiful in some localities, that the whole face of the rock is completely honeycombed by its numerous burrows; and considering the hardness of the stone and the delicacy of the shell, the fact of its ability to pierce so stubborn a substance is really

wonderful. Yet, although essentially a borer, and possessed of such singular powers, it sometimes is found perfectly free, and frequently is discovered merely lying in rocky crevices.

When a piece of rock is thickly studded with the Saxicava, it presents a curious and rather pretty appearance. The whole surface of the rock is covered with very small crimson projections, which, when touched, instantly vanish into the stone, leaving only the little holes through which they had protruded. These are the ends of the siphons which the Saxicava protrudes into the water, and by means of which it both procures nourishment and is enabled to respire. The general colour of the animal is yellow, which deepens into orange upon the siphons, becoming quite red at their extremities.

At fig. 8 of Plate I. is shown a shell which is closely allied to the preceding species, and which cannot be distinguished except by very careful eyes. This is called *Saxicava arctica;* and although in the figure it is easily distinguishable from the species which is shown at fig. 7, there are really few shells which are more difficult to identify. If the shells retained the same form throughout life, there would be no difficulty in separating them, inasmuch as the sharp spinous scales of the present species afford a boldly distinguishing character; but as both species change their shape in the course of their lives, as the young specimen of *Saxicava rugosa* possesses the same spinous scales as the adult *arctica,* and as both species lose these scales when old, a skilful eye is needful for the detection of any permanent characteristics. Such, however, may be found in the *beak* of the shell, *i. e.*, the part immediately above the hinge, and in the front edge of the shell; the former being sharp and leaning forward, and the latter being rather sharp and pointed, instead of being broad and rounded, as in the last species.

The colour of the animal is yellowish, and the siphons are of any shade of orange, rose, or brown. I-

derives its name of *arctica* from the fact that it is more common on the northern than on the southern coasts, thus reversing the habits of the preceding species. As, therefore, I have called the preceding species the Rough Stone-borer, I will designate this animal the Northern Stone-borer, both names being little more than translations of their accepted scientific titles.

It is found at various depths, but hides itself so cunningly that a casual observer would not notice it. If the reader should be able to manage a dredge, he will be nearly certain to find some specimens of *Saxicava arctica*, provided that he knows where to look for them. When the dredge hauls up a quantity of the large sea-weeds, search should be made among the roots, and in many cases the shell of the Northern Stone-borer may be found deeply imbedded in them. Sometimes it is hidden in masses of still living zoophytes, sometimes it is concealed among oyster-shells, and in many cases it is sunk so deeply into a tuft of growing coralline, that its presence would not be suspected until the plant was torn asunder.

It is a small species, the average length of the shells being half an inch.

We now pass to the second Plate, in which are depicted a number of curious and interesting species.

In the upper left-hand corner is represented a shell called *Petricola lithophaga*, which we may venture to term the ROCK-SHELL. Although this is not in itself an especially rare shell, it is not plentiful in England, is exceedingly scarce in cabinets, and anyone who possesses a specimen in tolerable preservation may think himself exceedingly fortunate. As its name implies, it buries itself deeply in the rock, respiring and obtaining nourishment by means of the siphons, which are separate and rather radiating from each other.

Foreign specimens of this shell are plentiful enough, as it is common in the Mediterranean, and abundant

on the coasts of France. But shells that have been obtained from the British shores are still extremely rare, and when one is perchance discovered, the fortunate collector is sure to notify his success in some scientific publication. Of its habits little or nothing is known, as is likely to be the case with a burrowing mollusc, unless some enterprising naturalist chooses to devote his energies to the study of some particular species.

At fig. 2 is seen a shell which is notable for the numerous sharp ridges which traverse its surface, and which are cut into teeth like those of a saw. This is the IRUS-SHELL (*Venerupis irus*), a shell which, on account of its remarkable shape and the ridges of its surface, is very easily identified. It is seldom found in deep water, preferring those parts of the shore which are just below low-water mark, and being often found in spots that are left day at very low tides. The empty shells are not at all unfrequent, especially on the southern coasts of England; but a living specimen is seldom to be found, unless especially sought for. Limestone rocks are favourite localities with the Irus-shell, and it is sometimes discovered in sponges and sea-weeds, like the Rock-borer which has already been described. As may be seen by a reference to the illustration, the siphons are united for half their length, and fringed at their tips. One of them is remarkable for the fact that it has a kind of supplementary tube which extends beyond the fringes. In the Mediterranean, the Irus is produced in vast quantities in some places, and the empty shells are flung in heaps upon its shores.

Here I may mention a fact the knowledge of which is useful to all collectors of shells. Generally, when a shell is found on our shores, it is presumed to be a genuine British species, and is classified as such; on the same principle that any plant, insect, reptile, bird, or mammal is considered as indigenous if it be discovered in a living state within the four seas. But this ought not to be the case with shells. A collector might

discover some spot on our coast which was rich in shells hitherto excluded from the British list, and yet be entirely mistaken if he were to consider them as true inhabitants of our shores. The fact is, that great quantities of shells are often conveyed from one country to another among the ballast, and when the sailors throw away the ballast overboard, they also fling into the sea various shells among the stones and sand. These shells are subsequently washed up by the tides, or dashed on the shore in a storm, so that they are picked up by hand, or inclosed in the multifarious contents of a dredge. Sometimes, too, a ship in ballast is cast upon the shore and beaten to pieces by the waves, when the ballast is necessarily thrown out, and in a year or two becomes a part of the shore. In this way many enterprising collectors have been deceived, and their mistake has not been discovered until many years afterwards.

We are now come to some shells that are popularly and appropriately called Gapers, because their valves are not wholly closed, but are permanently open at each end. The reader will remember that a similar structure is seen in the Flask-shells, as well as in others which have already been described, so that they all have a partial right to the name.

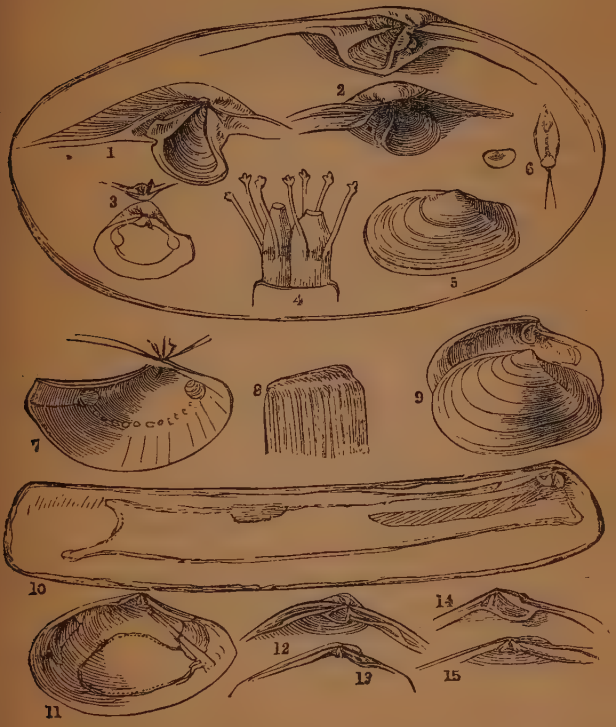
The species which is most generally known is the COMMON GAPER-SHELL, or OLD MAID (*Mya arenaria*); it is shown at Plate II., fig. 6. As it is rather a large species, the figure is necessarily reduced in size. The chief peculiarity of the Gaper-shells is seen at a glance, namely, a membranous tube which projects from the upper opening of the shells, and which contains the siphons. This tube is very thin, and is, in fact, the prolongation of a membrane which covers the entire body and the greater part of the shell, and which is technically named the "epidermis." Towards the hinder part of the shell the membrane is very thin, and at last is almost imperceptible; but in front it is

thicker, stronger, and slightly wrinkled, until it is merged into the tube, which is strongly wrinkled throughout the whole of its length. In the dried specimen the membrane is less conspicuous than is the case when the animal is living; and as it becomes dry it is apt to become very brittle and flake off in scales. It generally, however, retains its hold of the shell at the base of the tube, and may be seen tucked into the opening like a half-drawn-off glove.

The shell itself is white, and with age attains thickness, so that a full-grown specimen is very weighty in comparison with other species of the same size. The ordinary colour of the shell is pale brownish yellow; but, like many other boring species, it is liable to be stained by the substance in which it lies. Many specimens are quite black, having lain in the peculiarly offensive deposit which is found towards the mouth of most tidal rivers. Sometimes it is red, exactly of the colour of iron-rust; and in every instance the edges of the slight ridges which traverse its surface are sufficiently abraded by the very slight movements of the animal, to prevent their discoloration, and to show the real tint of the unstained shell.

In some places the animal is used for food, and is sold under the name of "Old Maid." Plentiful as it is, comparatively few are taken, because they lie so well concealed that none but experienced eyes can discover them. Small holes in the sand or mud are the only indications of their presence; and as there are innumerable marine animals which make little holes in the mud, to distinguish the breathing apertures of the Gaper-shell is not a very easy task. The shell is seldom found less than a foot from the surface, so that to procure a large number of specimens is rather a laborious business. In the northern parts of the world, however, there are several animals which know where to find the Gaper-shells, and which are able not only to detect them, but to dig them from their muddy holes. The arctic fox is a terrible de-

vourer of Gaper-shells, and the walrus is also able to obtain them. Even birds know the value of the Gaper-shell, and many of the larger species can disinter the molluscs with their beak, as easily as the foxes with their paws.



There is a curious structure in the hinge of this species which is worthy of notice. At the upper part of the accompanying illustration is seen part of a

valve of a Gaper-shell, and just below the "umbo," or boss of the hinge, is placed the peculiar structure which has been mentioned. At fig. 2 is drawn the hinge of the left valve, on which is a strong piece of horny and very elastic substance, shaped something like one of the fans of a screw propeller. The hinge of the right valve is seen at fig. 1, where is shown the projecting portion which corresponds to the horny fan. This projection is of considerable length, is very strong, and highly polished and smooth on the under side; the upper side being comparatively rough and slightly wrinkled. When the two shells or valves are inhabited by the animal, the shelly projection presses against the horny fan, which acts as a spring, and gives the shells a constant tendency to fly open, which is only counteracted by the force of the powerful muscles which close the valves, and which leave a deep impression of their attachment upon the interior of each valve. This curious apparatus holds the valves apart, much as the spring of a pair of shears keeps their blades open.

Just below theG aper-shell is drawn another species, which we may term the BLUNT GAPER (*Mya truncata*). This species derives its name from the shape of the shell, which looks as if it had been abruptly cut off or squared at the end from which the siphons protrude. In this figure the animal is shown as it appears when in health and unalarmed, the siphons with their fringed ends projecting from the end of the tube.

Those who really desire to study the marine shells of England, ought to procure some living specimens of the Gaper-shells. Both species can often be found in the same locality, and dug out of their muddy homes without much labour. The structure of the animal is well worthy of examination, as the creature forms one of the simplest examples of the molluscs, and becomes a key to the more complicated anatomy of other species. When the valves are opened, the resem-

blance between the animal of the Gaper-shell and some of the Ascidians is evident at a glance; and indeed, as Messrs. Forbes and Hanley well remark, the aspect of a living Gaper-shell is almost exactly that of an elongated Cynthia, against whose sides two plates of shell have been pressed.

The shell of the Blunt Gaper is variable in form, being so frequently deformed that a large and undistorted specimen is not very often seen in the cabinets of ordinary collectors.

At Plate II., fig. 5, is drawn a figure of the common BASKET-SHELL (*Corbula nucleus*), which is so plentiful on our coasts, but which is seldom picked up on the shore. It affords an excellent type of the family to which it belongs, the various distinguishing points being very strongly marked. The two valves are exceedingly unequal, the right being large, deep, rounded, and completely overlapping the left valve, which is flat and comparatively small. It is nearly covered with a membrane like that of the Gaper-shell, while the other valve is bare. The beaks are boldly marked, as may be seen by reference to the illustration, which shows the left valve as it appears when partially overlapped by the other. At page 25, fig. 3, is drawn the inside of the shells, showing the curved tooth of the right valve, and the corresponding hollow and cartilage in the left valve. This is a little shell, seldom exceeding half an inch in length.

Another shell, belonging to the same family as the Basket-shell, is drawn at Plate II., fig. 4. As may be seen by reference to the illustration, it is of a very remarkable shape, being prolonged at the hinder end into a sort of tube, and the body of the shell swelling out boldly, so as to make the contrast greater. The valves are covered with a membrane, which is variable in hue, but is generally of a pale fawn colour. The shell itself is very delicate in appearance when the

membranous covering is removed, and is partially transparent. One of the most curious points in connection with this species, is the singular termination of the siphons, the ends of which are surrounded by long tentacles, each having at the tip several finger-like projections. (See the Cut on page 25, fig. 4.) This shell is called *Neæra cuspidata*, the former name being given to it in honour of the Roman lady celebrated by Horace, and the latter being in allusion to the pointed form of the shell. It has been found off Northumberland, but is more frequent in Scotland.

CHAPTER IV.

THE PANDORA SHELLS—PECULIARITY OF THEIR APPEARANCE—ORIGIN OF THE NAME—STRUCTURE OF THE SHELL, HINGE, AND ANIMAL—THE BASKET, OR THRACIA—LOCALITIES WHERE IT IS FOUND—THE BEAN-BASKET—STRUCTURE OF THE SHELL AND THE SUPPLEMENTARY PLATE—THE SPOON-BASKET, OR COCHLODESMA—DESCRIPTION OF THE SHELL—REMARKABLE HINGE—REASON FOR ITS NAME—THE RAZOR-SHELLS, AND ORIGIN OF THEIR NAME—GENERAL STRUCTURE OF THE SHELL AND ANIMAL—THE SABRE RAZOR—HABITS AND LOCALITY OF THE SHELL—DIFFERENT METHODS OF CATCHING IT—THE POD RAZOR-SHELL—WHY SO CALLED—THE GROOVED RAZOR-SHELL—HOW TO DISTINGUISH THE DIFFERENT SPECIES—THE PAPER RAZOR-SHELL; ITS FRAGILITY—STRUCTURE OF THE ANIMAL AND HINGE—LOCALITIES WHERE IT IS FOUND—THE SHORT RAZOR-SHELL—PECULIARLY FORMED SHELL AND HINGE—THE TELLEN SHELLS—THE SUNSET SHELL—ORIGIN OF ITS NAME AND ITS HABITAT—THE BLUNT TELLEN; ITS FORM AND COLOUR—THE PORCELAIN TELLEN—BEAUTY OF THE SHELL—THE ORANGE TELLEN; ITS SHELL AND HINGE—THE CONVEX TELLEN; ITS SHAPE AND HUE—THE ABRA-SHELLS; THEIR FRAGILITY AND DEFENCE—THE CURIOUS SIPHONS—THE FURROW-SHELL—ITS VARIABLE FORM AND COLOUR—ITS HABITATION—METHOD OF OBTAINING PERFECT SPECIMENS—MUD, ITS ADVANTAGES AND DEMERITS—A PROVERB VERIFIED—MUD-WADING, AND ITS DISCOMFORTS—SEARCHING FOR SPECIMENS—A TEST OF ZEAL—A NARROW ESCAPE—DETERGENT PROPERTIES OF THE MUD.

THE pretty little shell, which is represented of its natural size on Plate II., fig. 3, is rightly severed from the Basket-shells, on account not only of its shape, but of the character of the shell. It is much flatter than the Basket-shells, although, like them, it has one valve longer and deeper than the other, and overlapping it at the edges. A glance at the shell will, however, detect one of the chief points of difference. The surface is shining and polished, and has a nacreous aspect, like that of the pearl oyster; this appearance being due to the manner in which the particles of the shell are arranged. On account of this peculiarity, the shells belonging to this genus are

called by the name of "Pandora," because the pearly box-like shell is fancifully thought to resemble the magic box in which Pandora kept her fatal gifts. As one end of this species forms a kind of beak, it is called the BEAKED PANDORA (*Pandora rostrata*).

The animal, too, is rather curious, as may be seen by reference to the illustration. The siphons are completely united to the end, but instead of the apertures opening in the same line, they diverge widely from each other. At the Cut on page 25, fig. 7, is seen the inside of the deep valve of this species, as well as the hinge of the flat valve. This sketch was taken in order to show the peculiar hinge, the shelly teeth, and the narrow and nearly straight elastic cartilage by which the valves are held open. Only two species of this genus are acknowledged as British; and the present species, although plentiful in the Channel Islands, is thought by some persons to have but a weak claim to the title of British.

We now come to another family, named Anatinidæ, or Lantern-shells, which are also burrowers, and generally live in the depths of sand or mud, although they are sometimes found in the cavities of rocks. One of the best-known British species is that which is shown at page 25, figs. 5 and 6, and which is called *Thracia phaseolina*. Perhaps we may name it the BEAN-BASKET, the word *phaseolina* being formed from a Latin word signifying a bean.

This is a very common species, and found on most of our shores. Plentiful as it is, a really perfect specimen is not very often seen; for, in the first place, the shell is so fragile that it is easily crushed, and in the next place, it is a compound shell, having a supplementary piece which readily falls off, and is mostly detached before the specimen is discovered. If the reader will take a perfect shell and examine the hinge, he will see that just beneath the beak there is a small semilunar plate of shell, which partially overlaps the

top of each valve. At fig. 6 this shelly plate or "ossicle" is shown as it appears in its place, and a magnified figure of it is also given. It is exceedingly convex on one side and flattish on the other, but with a deepish hole in it. It is a small species, the specimen being represented of the natural size.

At fig. 9 of the same illustration is seen a shell belonging to the same group, and which we may call, for a reason which will presently be seen, the SPOON-BASKET. Its scientific name is *Cochlodesma prætennue*.

This is a delicate and fragile shell, small, being seldom an inch in length, at all events on English shores, though off the Scottish coast it sometimes measures an inch and a half in length. When recent, the shell is covered with a very fine membrane; but when dry, the membrane shrinks closely to the shell, and finally flakes off, leaving the china-white shell exposed.

The chief peculiarity of the shell lies in the hinge. If the reader will again refer to the illustration, he will see that from the hinge of the upper valve a small shelly plate projects into the interior. This plate is exactly like the bowl of a spoon, and affords the reason for the name of Spoon-basket. Corresponding to the "spoon," a stout piece of elastic cartilage is attached to the other valve, serving, as has already been mentioned, to hold them apart.

Our next group of shells is that curious family which are appropriately termed Razor-shells, because, when perfect, the shell looks something like the handle of a closed razor. To mistake a Razor-shell is impossible, as there is no other group that bears any resemblance to these curious molluscs. Yet a short inspection of the shell will show the connection that exists between them and the species which have already been described. If it were possible to soften a Basket or a Lantern-shell, and draw it out lengthwise, as a glass tube can be drawn out in a spirit-lamp, a very

tolerable imitation of a Razor-shell would be formed. The valves are closed along the sides, but gape at each end, from the projection of the siphons at one extremity and of the foot at the other. A figure of the shell of the common species, the SABRE RAZOR (*Solen ensis*), may be seen on Plate II., fig. 9, and immediately below is an opened shell of another species, the POD RAZOR (*Solen siliqua*), which is given in order to show the manner in which the animal lies between the shells.

The foot is of considerable size, and is used in enabling the creature to traverse the perpendicular hole which it makes in the sand or mud. When at its ease, the Razor-shell usually ascends to the top of its burrow, and the ends of its siphons are plainly visible, looking much like a keyhole in the sand. At the least alarm, however, such as a heavy step, the animal squirts a small stream of water in the air, and shoots to the bottom of its tunnel.

Should it be wanted for a specimen, it can easily be obtained by getting a spade inserted by the side of the hole, and dropping a little salt on the animal below. It instantly rises to eject the salt, and by a judicious use of the spade may be thrown out on the ground and captured. The spade-stroke must be made very quickly, or the Razor-shell will again disappear, and cannot be induced to re-appear even for a pound of salt. There is another simple method of capturing it, which is much in use when the creature is only wanted for the table, or for bait, but which is sure to damage both shell and inhabitant. A stout iron wire is bent and sharpened at one end, so as to form a barb, and is then plunged into the hole. The point is sure to pass between the valves, which are instantly closed, and so enable the fisher to draw the Razor-shell out of the hole. Experienced fishers generally give the wire a half turn before they withdraw it, so as to fix it more tightly in the animal.

All the Razor-shells are edible, and if properly

dressed, are among the best molluscs that are brought to table.

The Sabre Razor can at once be distinguished by the shape of the shell, which is curved like the sabre still in use in some countries. These shells are very narrow, their length being eight times their width. The hinge is nearly at the extremity of the shell, and has a single slightly-grooved tooth on the right valve. This species is seldom taken in ground which is above low-water mark.

The Pod Razor derives its name from its resemblance to the pod of a bean. The shell is straight, the hinge nearly at the end, having two stout teeth in one valve, and a single axe-shaped tooth in the other, so placed as to pass between the two teeth of the opposite valve. The exterior of the shell is covered with a rather strong yellowish membrane, and the inside is beautifully white and polished, with a slight pearliness when viewed sideways.

Another species, the Grooved Razor (*Solen marginatus*), is straight, like the preceding species, but can easily be distinguished by the peculiarity from which it derives its name, *i.e.*, a groove which runs round the front end of the shell, and looking as if a string had been tied round it when soft. It has one tooth in each valve, fitting by the side of each other when the valves are closed. At page 25, fig. 8, is seen a figure of the end of the shell, showing the groove. In order that the reader may know the place where the teeth are situated, a sketch of the Pod Razor-shell is given at fig. 10, page 25, in which the two teeth are seen at the right-hand upper corner of the shell. The remarkably-shaped depression caused by the muscles which draw the valves together is also shown.

On Plate III., fig. 1, is shown an animal which was formerly classed with the true Razor-shells, but is now separated from them for several reasons. Its scientific name is *Ceratisolen legumen;* and on account of the

delicacy of the shell, I propose to call it the PAPER RAZOR-SHELL.

A glance at the figure will show one important peculiarity, namely, the length of the siphons and their divergence from each other; whereas, in the true Razor-shells, these organs are short, and united to the tips. The shell is very delicate, fragile, and semi-translucent, something like the well known "egg-shell" china. The hinge is remarkable for the curious teeth, which look as if a pair of white horse-shoes had been set edge to edge, and then fastened into the shell so that the openings should project inwards. Into these hollows the teeth of the other valve are fitted, so that the shells are locked firmly together when the muscles are contracted. Although not a common species in many parts of England, it can be obtained abundantly at Bideford and other parts of the Devonshire coast.

At fig. 2 of the same plate is seen another species, which may be called the SHORT RAZOR-SHELL (*Solecurtus candidus*). At a hasty glance it would scarcely be recognised as allied to the Razors, inasmuch as it looks more like a much-worn Piddock.

Though scattered over many parts of the British coast, this species is not very often found, because it inhabits tolerably deep water, and can only be obtained when the dredge happens to tear up a large lump of mud. The tubes of the siphons are rather long, and project boldly from the shell, but they do not diverge from each other like those of the preceding species. In the hinge there are two teeth in each valve.

Several species of this genus are known to inhabit the British seas; and one of them, the SMOOTH RAZOR (*Solecurtus coarctatus*), is shown at fig. 3 of the same Plate.

We now come to another family, termed the Tellinidæ, or Tellens. These are also burrowers, and are

mostly found in spots where sand and mud are mixed together. They are mostly remarkable for their beautiful colours, presenting in this respect a bold contrast to the dull whites and browns of the preceding shells. The animal always has very long and slender siphons, and a tolerably powerful foot.

Our first example is seen at Plate III., fig. 6, and is known by the popular term of SUNSET-SHELL (*Psammobia tellinella*), because the diverging rays which traverse the shell are fancifully thought to resemble the beautiful beams of the setting sun as they are thrown upon the evening clouds. These rays are generally pink, and in a specimen now before me they are bright red on a pale yellow ground, but are much broken up and dissimilar on the opposite valves. The figure represents the shell of its natural dimensions. It is widely spread, but is seldom if ever taken without the help of the dredge, though the separate valves are sometimes cast on the shore.

At fig. 9 is shown the shell of another species of the same genus, which we may call the STRIPED SUNSET-SHELL (*Psammobia Ferroensis*). It is a larger and handsomer species than the last, being nearly two inches in length when adult, and having the peculiar markings very distinct. The remarkable diverging teeth of this genus are seen at page 25, fig. 15.

We now come to the typical shells of this group, which belong to the genus Tellina. This is a very large genus, at least two hundred existing species being known in different parts of the world, of which some ten or eleven are acknowledged as British. The Tellen shells are inhabitants of the sand and mud, and sometimes bury themselves to a considerable depth. One of the best British examples is the BLUNT TELLEN (*Tellina crassa*), a figure of which may be seen at Plate III., fig. 8. This is a pretty shell, and rather larger than the generality of its kind,

measuring nearly two inches in length. The colour is variable, but is usually whitish, and marked with warm red rays something like those of the Sunset-shells. In some specimens the inside is generally orange, but is sometimes nearly white.

On the same plate, at fig. 5, is represented another species, which may be called the PORCELAIN TELLEN (*Tellina tenuis*), on account of the polished surface of the shell, which has a gloss exactly like that of the finest porcelain. Unfortunately, the shell is extremely fragile, and so may doubly deserve its name. The figure has been drawn in order to show the chief peculiarities of the animal, namely, the slender siphons and the fringed edges of the mantle, which just show themselves beyond the shell.

This is extremely plentiful on our shores, and although it is a burrower, the empty shells are thrown on the shore in vast abundance. It is extremely variable in colour, but is always beautifully tinted. A specimen now before me is of a lovely blush-rose colour, with bands of carmine running round it as seen in the figure, and changing gradually to orange at the hinge. A few streaks of white are also strewn over the shell, and present an elegant contrast to the pink and orange.

Another beautiful species is the ORANGE TELLEN (*Tellina incarnata*). It is a much larger shell than the preceding, and is narrower in proportion. The Blunt Tellen is almost as wide as it is long, while the Orange Tellen is nearly half as long again as its width. The colour of this shell is warm orange on the outside, with streaks of pink and white; and on the inside is a still brighter orange. It is rather a flat shell, translucent and fragile. It is usually found on the southern coasts. At page 25, fig. 11, is seen one of the valves of this species, showing the general shape of the shell, as well as the minute teeth of the hinge.

At fig. 4 of Plate III. is shown another example of this large and important group of shells; we will call it the CONVEX TELLEN (*Tellina solidula*). The species which have just been mentioned are rather flat, much polished, and fragile, whereas the present species is opposed to them in each of these respects. It is a short, sturdy kind of shell, rather dull on the exterior, and stout in substance. The valves are very convex, so that a perfect specimen can be rolled along the floor without difficulty.

The colouring is variable, but never attains the brilliancy which adorns so many other species, seeming, indeed, as if half washed out. In the specimen before me it is nearly white, over which are drawn a few broad bands of very pale pink, deepest towards the hinge, and becoming almost yellow at the edge. Other specimens are nearly yellow, some are flesh-colour, some a tolerably deep pink, while a very few are creamy white. This shell is found in sand, some five inches below the surface.

On Plate III., fig. 7, is drawn a shell which has the elaborate name of *Syndosmya alba*. Now, as the simple and well-sounding name of Abra has been given to the shells of this genus, although the longer title has been accepted by Messrs. Forbes and Hanley, I propose to call them the Abra-shells, and the present species the WHITE ABRA, being a translation of the specific name.

This name, however, is not a very happy one, inasmuch as all the British Abra-shells are more or less white, and this particular species is not distinguished in any way by its superior whiteness. This is a small species, seldom much exceeding half an inch in length. It is very fragile, but during life it is partly defended by a thin but tolerably tough membrane, which extends over the shell, and is generally of a yellowish hue. The valves slightly gape at the extremities. It is a plentiful shell in sand and mud, particularly

where the two substances are mixed, and its empty valves are often found upon the shore.

The animal is remarkable for the length and mobility of its siphon tubes. These organs are slender, unconnected except at their bases, elastic, and are capable of being extended until they equal the length of the shell. They can also be expanded at will, until they are at least three times their usual size. Like the corresponding organs in several other shells, they are covered with a thin membranous tube. About four species of Abra-shells are known to be British.

There is another curious shell which is clearly related to the Abra-shells, and which is generally found in the mud at the mouths of tidal rivers. This is the species called scientifically *Scrobicularia piperita*, a name which we may translate almost literally by FURROW-SHELL. It derives its name from the numerous deep but narrow furrows which run round the shell, and which prevent it from assuming any gloss.

Many of the previously-mentioned shells are very variable in form and colour, but this species is of so uncertain a form, that it has been separated into various species by different conchologists. When unstained by the mud in which they have rested, the valves are yellowish white on the outside, sometimes having a slight tinge of orange. The interior is white and glossy, sometimes tinged with yellow, and the hinge is formed on a similar plan to that which has been so often mentioned. A drawing of the hinge may be seen at page 25, fig. 14.

This is a very plentiful species, and as it has a love for brackish water, it may be found at some distance from the mouth of the river, so that it is exposed to the alternation of salt, brackish, and nearly fresh water. As it lives at a considerable depth in the mud, it is seldom taken in a living state except by those who search for such objects; and, as a general rule, the specimens which are seen in ordinary cabi-

nets are merely empty valves thrown ashore by the tide.

There is good reason why this and similar shells should not more frequently be found. As anyone must know who has been accustomed to the dredge or trawl, the black mud in which these shells love to dwell is peculiarly offensive both to the touch and the olfactory nerves. It is sticky and slimy, and will not come off the hand without much difficulty. If the blade of an oar should happen to strike the mud, some of the black, slimy substance is sure to adhere to it, and even after an hour's hard rowing, mud will still be on the oar. "Throw plenty of mud, and some of it is sure to stick," is a well-known proverb, whose force is never thoroughly understood until the various properties of such mud have been practically tested.

Wading in the mud is as disagreeable a process as can well be imagined. Unless the wader be furnished with regular mud-boots, he can wear no covering on his feet; there is not an ordinary boot in existence that will remain on the leg when it is once plunged deeply into the mud. If the wader should dispense with shoes and stockings, he has another disadvantage to overcome, namely, the risk of treading on bits of stick, broken stones, or empty shells, which latter objects have a peculiar knack of lying with their sharp edges uppermost.

No one can judge of the depth to which he may plunge at the next step, and yet he must of necessity keep on the move, or he would sink so deeply that he would run a great risk of being permanently imbedded. Nothing is easier, too, than to lose the balance when mud-wading; and if the wader should happen to lose his perpendicular, down he must subside, the tenacious and treacherous mud preventing him from making the step that would restore his balance. All this time the pressure of the feet forces up quantities of the offensive gases — sulphuretted hydrogen, for example — that have been formed by

the decomposition of sundry animal and vegetable substances; so that in no sense does the mud-wader tread a path of roses, except, perhaps, as far as the thorns are concerned.

Supposing that the enthusiastic naturalist has procured a quantity of the mud, and is about to examine it for the sake of discovering its various inmates, he has still no savoury task before him. Armed with his sieve and a bucket or two, he expends a vast amount of time in breaking up the tenacious substance and washing it through the sieve, until all the mud runs through the meshes, and all its inhabitants are left in the sieve.

Should the locality be judiciously chosen, the explorer is fully repaid for his trouble, inasmuch as the mud is the favoured habitation of a vast number of animals belonging to different classes, such as molluscs, crustacea, and worms. He will thus obtain specimens of shells such as cannot be procured in any other manner, and will be able to secure the living animal as well as the empty shell—the former being, indeed, the more valuable to a true zoologist. But he must previously make up his mind that he will have to undergo such discomfort as none but a true and earnest zoologist would voluntarily endure; and if he thinks to gain the treasures without working hard for them, he will find himself grievously mistaken.

Perhaps the powers of mud are never so well developed as is the case when the explorer has allowed his enthusiasm to overpower his judgment, has forgotten that the tide is ebbing, and has allowed his boat to be "hung up" on a mudbank. From such a situation there is no escape. Were the boat surrounded with water, it would be possible to swim on shore; but when it is surrounded with mud of treacherously smooth surface and unknown depth, there is no help for it but to wait for the next tide. I have had several narrow escapes from this mishap, and not long before writing these words was nearly placed in a very awkward predicament.

One of my friends, in whose yacht I often take a cruise, had anchored his vessel in the Medway while the tide was still flowing, and proposed a pull in the dingy, for the purpose of investigating some of the innumerable creeks of that river. We pulled through several creeks, and at last rested on our oars in one, for the purpose of watching a kingfisher that was sitting on a stump and peering into the water for a passing fish. Suddenly I was startled by a shout from my friend, with an order to pull as hard as possible. I did so, though not knowing why, but soon learned the reason. There was a bar at each end of the creek, and while we had been lying on our oars, the tide had turned and was fast ebbing.

My companion had caught a glimpse of the bar at one end, and so tried the other, in hopes that it might be lower, and allow the boat to pass over. It *was* lower, but the keel scraped a deep groove as we crossed it, and in another five minutes it would have been impassable. Had those few minutes been lost, we should have been imprisoned in an open boat from 3.30 p.m. to 3 a.m., without a morsel of food or a drop of water on board, without any clothes except the usual sailor suit, and with a sharp N.E. breeze that quite chilled the fingers when we ceased from rowing.

Ever since that time we have been most careful of the tide, and the owner of the boat vowed that she should not leave the yacht for five minutes without some potted meat, some biscuit, a jar of water, a box of matches, and a couple of warm rugs.

In spite, however, of its adhesiveness, its colour, and its odour, the mud has one advantage. It acts as a kind of marine soap, and does really cleanse the hands thoroughly, a property which is very useful when one is out for a cruise, and the supply of fresh water on board runs short.

CHAPTER V.

THE DONACIDÆ OR WEDGE-SHELLS, AND THEIR GENERAL FORM — THE COMMON WEDGE-SHELL—STRUCTURE OF THE ANIMAL—THE SIPHONS, AND ANALOGY WITH THE ASCIDIANS—HOW TO DISTINGUISH THE SPECIES—USUAL COLOUR—THE POLISHED WEDGE-SHELL AND ITS PRETTY COLOURING — THE TROUGH-SHELLS — REASON FOR THE NAME—THE RADIATED TROUGH-SHELL—ITS BEAUTIFUL HINGE—THE ELLIPTICAL TROUGH-SHELL—FORM OF THE ANIMAL—THE BLUNT TROUGH-SHELL—WHY SO CALLED—THE OTTER-SHELLS—UNCERTAINTY OF THEIR POSITION—DIFFICULTY OF CLASSING THEM—HABITS OF THE OTTER-SHELLS—THE OVAL OTTER-SHELL—ITS DIMENSIONS AND GENERAL SHAPE—THE OBLONG OTTER-SHELL——WHERE FOUND—STRUCTURE OF THE HINGE—THE CARPET-SHELLS, AND ORIGIN OF THEIR NAME—THE BANDED CARPET-SHELL—DIFFICULTY OF OBTAINING IT—ITS BEAUTIFUL AND VARIABLE COLOURING—STRUCTURE OF THE HINGE—ITS FAVOURITE LOCALITIES—THE GOLDEN CARPET-SHELL, AND ITS COLOURS—THE GROOVED CARPET-SHELL—EXPLANATION OF A SCIENTIFIC TERM—DEFORMED SHELLS—THE LITTLE CARPET-SHELL; ITS FORM, SCULPTURE, AND COLOUR—THE SMOOTH CYTHEREA—HOW RECOGNISED, AND WHERE OBTAINED—THE BANDED VENUS-SHELL—ITS FORM AND VARIABLE COLOURING—THE WART VENUS-SHELL—ORIGIN OF ITS NAME—THE STRIPED VENUS—DELICATE SCULPTURE OF ITS SURFACE—WAMPUM; WHERE OBTAINED AND HOW MANUFACTURED.

THE next group is that which is called Donacidæ, or Wedge-shells, on account of their three-cornered, wedge-like shape. They are all sand-burrowers, and none of them are of any great size.

One of the most plentiful British species, the COMMON WEDGE-SHELL (*Donax anatinus*), is represented at Plate III., fig. 13, in order to show the remarkably stout and powerful foot, the frilled mantle, and the long diverging siphons with their fringed ends. The foot is usually of some tint of yellow, and the siphons are pale orange. It is easy to distinguish the offices of the two siphons, provided that the specimen be fresh, for the fringe of the inferent siphon is formed of eight projections, while the efferent orifice has only six. The reader will remember that these terms

have already been explained on page 7. It is rather remarkable that the comparatively imperfect Ascidian should have the two siphons distinguished in precisely the same manner as those of the Wedge-shell.

This species may easily be distinguished from its congeners by opening it and examining the inner edge of the valves. If the finger be run along them it will encounter a peculiar roughness, which proceeds from a series of very short but very decided grooves which surround the inner edge, and look something like the "milling" on the edge of a new sovereign. The hinge is shown at page 25, fig. 13, in order to exhibit the small and diverging teeth.

The colour is usually pale olive, streaked with more or less of brown, and a number of very various white lines are drawn from the hinge to the edge, so as to present a radiated aspect. The exterior of the shell is covered with a thin, smooth, and shining membrane, to which much of the colour is owing; and when this membrane is removed, the shell itself is seen to be whitish with a little lilac. The inside of the shell is rather variable in colour.

This is a small species, a full-grown specimen being usually rather more than an inch in length. It is extremely common, and as it only resides at the depth of two or three inches, is frequently found.

At fig. 11, Plate III., is depicted the shell of another species, the POLISHED WEDGE-SHELL (*Donax politus*).

This is a remarkably pretty species, and may be at once recognised by the broad white band which proceeds from the hinge towards the hinder end of the shell. This white band is found in all specimens of this shell, although the colour may vary from yellow to brown. This colour is partly caused by the membrane or epidermis, which has been already described. A very pretty specimen now before me is mostly yellowish brown, with four or five narrow whitish

streaks drawn round the valves, following the line of their edges. The broad white band which crosses the shell is in this specimen made more conspicuous by a patch of chesnut-brown through which it passes, and which reaches to the edge of the shell.

The next group is called Mactridæ, or Trough-shells, from a fancied resemblance between the empty valves and a baker's kneading-trough. All these shells inhabit sandy shores, and are found at the depth of an inch or two from the surface. The foot is very extensible, so that the animal can use it for progression, and move about with some little activity.

The typical species, the RADIATED TROUGH-SHELL (*Mactra stultorum*), is represented at Plate III., fig. 15, of the ordinary size. This is a very common shell, often found on the shore, and consequently a favourite with young collectors. In colouring, it is one of the most variable of shells, being of every shade from ashen olive to brown. But, however variable may be the ground colour of the shell, it is always notable for a number of white bands that radiate from the hinge to the edge, and have given to the shell its popular name.

The arrangements of the hinge are most elaborate and beautiful, the shelly processes which support the elastic cartilage, and which press against it, being extended along the greater part of the back of the shell. This structure is shown at page 25, fig. 12.

In order to show the form of the animal, another species has been drawn at Plate III., fig. 12, which may be called the ELLIPTICAL TROUGH-SHELL (*Mactra elliptica*). Its long, pointed foot may there be seen, as well as the rather stout siphons. This species is moderately convex and decidedly triangular in form, and has its surface comparatively smooth. Another species, shown at Plate III., fig. 14, is the BLUNT TROUGH-SHELL (*Mactra truncata*), so called from the manner in which it is flattened at either side, so as to

present a heart-shaped mark at each side of the hinge.

It is a very convex shell, and its surface is covered with rather deep and very regular grooves, each groove following the line of the edge. Indeed, the whole outline of the shell is almost exactly that of a very thick axe-head, much rounded towards the spot where it is fitted to the handle. It is a tolerably plentiful shell, especially on the northern coasts of England, but is seldom taken except with the dredge or trawl.

On Plate II., fig. 8, is drawn a shell which has some very curious characteristics.

If compared with the two figures immediately above, it will be seen that a very strong resemblance exists between the three, so that they appear to belong to the same group of shells. The general shape of the shell is very similar; the siphon tubes are formed after a similar manner, and a membranous tube envelopes them and extends over the shell itself. On account of these points of resemblance, this shell has by many writers been classed with the Gaper-shells; indeed, the resemblance between the animal of the Gaper-shell, and that of the OTTER-SHELL, as this creature is popularly named, is so palpable, and their habits are so similar, that we should be justified in classing them together, if we only considered the animal and not the shell.

But, unfortunately for those who think that it is one of the Gapers, the shell has all the characteristics of a Trough-shell, and therefore has a kind of right to be ranked among that group. This knotty problem is as yet undecided, and I have therefore followed the arrangement of Messrs. Forbes and Hanley, and placed it with the latter group.

As is implied by the scientific title, *Lutraria*, the Otter-shells inhabit the mud, into which they burrow deeply, exactly as do the Gapers, and this habit affords one reason why they are not seen more frequently in

the cabinets of ordinary collectors, although their great size renders them so conspicuous. The commonest species, *Lutraria elliptica*, or the Oval Otter-shell, sometimes measures more than five inches in length and three in width, so that it may fairly claim the honour of being one of the largest British shells. A specimen now before me is almost five inches in length, and as the substance is thick and solid, its weight is by no means inconsiderable.

The general aspect of the shell is very similar to that of the Gaper, and the resemblance is increased by the manner in which it gapes at both ends. From one end protrude the siphons, which are united throughout their length, and from the other emerges the large and powerful foot, by which the animal is enabled to traverse its muddy tunnel. The colour of the siphon-tubes is white at the base, changing to yellow at the extremity. The colour of the shell itself is greyish white, but it is mostly covered with a membrane of an olive-brown colour, and is often stained so deeply with the mud that its original hue is quite destroyed. The inside of the shell is white, with a very slight tinge of bluish grey, like white china.

The hinge of the Otter-shell bears a very close resemblance to that of the Trough-shells, as may be seen by reference to the engraving on page 25. At the upper part of the illustration is an outline of the Oval Otter-shell, given for the purpose of showing the hinge, as compared with the same part in the Trough-shells. If, therefore, we rest our proofs on the animal, the Otter-shells belong to the Gapers; if on the shell, they must be classed with the Trough-shells.

In this group there is a bold projection of shelly substance, which is technically named the "fulcrum," and somewhat resembles a spoon in shape. Each valve possesses this fulcrum, but in the right valve there is a strong, boldly projecting tooth, which lodges in a corresponding pit or socket in the opposite valve. In each fulcrum the hollow for the ligament

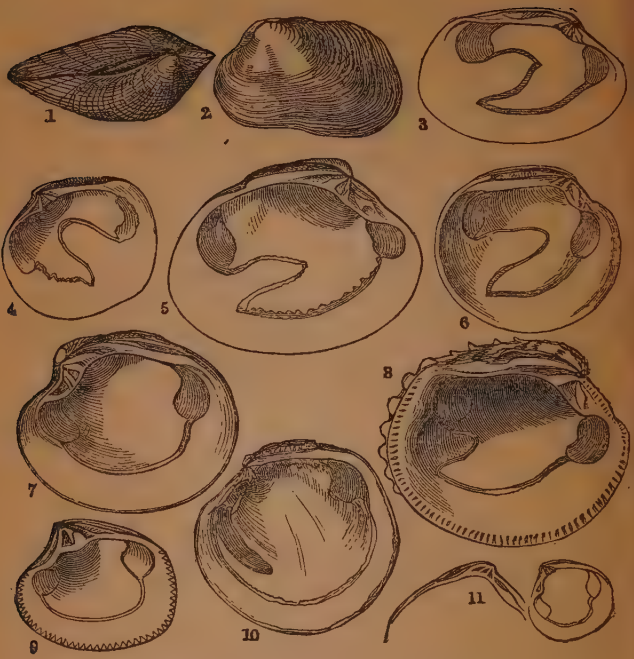
is rather deep, and adds much to the general spoon-like aspect. When the two valves are perfectly fitted together, the working of the tooth in the socket can easily be seen through the gaping end of the shell.

Those who wish to obtain specimens in good condition should examine the muddiest shores at low water; and if they will work at the task of disinterment, heedless of the various discomforts to which they will be necessarily exposed, they may be tolerably sure of success. The OBLONG OTTER-SHELL (*Lutraria oblonga*) is not so plentiful as its oval relative, but may be found on our southern coasts, as well as on the shores of Ireland. The latter species is remarkable for the extremely deep mark left in the interior of the shell by the muscle that holds the valves together. It is a smaller species than the preceding, four inches being the average length of a good specimen. It may at once be distinguished by its curved or "arcuated" outline.

We now come to a group which are called, from their beauty, the Veneridæ, or Venus-shells. Their outer surfaces are more or less sculptured, and are rendered very attractive by the colours with which they are bedecked. They are strong, thick, solid, and are of a porcelain-like look, something like many of the univalves.

The first of the Venus-shells are those which are called by a name which in the Latin signifies tapestry, and which we may therefore term CARPET-SHELLS. They derive this name from the disposition of their colours, which are arranged in patterns like the "background" in tapestry.

At Plate IV., fig. 7, is represented the BANDED CARPET-SHELL (*Tapes Virgineana*), a species which is seldom found by those who do not know how to look for it, and is easily discovered by those who understand its habits. Its colour is variable, but a pinkish hue generally prevails. The surface of the shell is grooved



with lines that follow the line of the edge, and is marked by several deeper and wider grooves at about a sixth of an inch apart. The beaks, however, are quite smooth, and always much paler than the rest of the shell. The interior of the shell is white, with shades of pink or orange. In the specimen before me, the colour is white at the edges, and becomes richly pink towards the hinge, the pure white teeth of which afford a beautiful contrast of colour.

The teeth of the hinge, as well as the impression made by the muscle on the shell, may be seen at fig. 3 of the accompanying illustration.

It is called the Banded Carpet-shell, because several bars of a paler hue than the general colour of the shell are drawn from the hinge to the edge, radiating from each other as shown in the illustration.

In form, this shell is decidedly heart-shaped and boldly convex. When opened, the structure of the hinge is well worthy of notice, the boldly projecting teeth fitting into each other just like the fingers of the clasped hands, and effectually preventing the valves from moving in a wrong direction.

This species is one of the mud-lovers, and prefers deep water, seldom being found where the water is less than forty feet in depth, and having been dredged up from a depth of nearly nine hundred feet. The best specimens are said to be taken at Guernsey.

At Plate IV., fig. 9, is shown another species of this group, named the GOLDEN CARPET-SHELL (*Tapes aurea*), from its yellow hue. In this species yellow is always the prevailing hue, just as is pink with the Banded Carpet-shell. The yellow, however, is of extremely various tints, and in some specimens fades into an almost pure white. In some examples it is variegated with reddish brown, and in a specimen now before me there are several vague bands of grey. The inside of the shell is generally of the same hue as the exterior, but is of a duller character.

A very conspicuous example of this group is given at Plate IV., fig. 14, which we may term the GROOVED CARPET-SHELL (*Tapes decussata*), on account of the numerous grooves which traverse the shell in two opposite directions, so as to divide its surface into a number of very small compartments.

As the term "decussata" is one which is frequently used in conchology, I will explain it as briefly as possible. To say that a shell is decussated does not convey very definite ideas to those who are not versed in the language of science, any more than does the well-known explanation of the word, "network," *i.e.*,

anything reticulated or decussated, with interstices between the intersections. The word "decussated" is derived from the Latin word signifying the number 10, and is used to express the effect produced by lines crossing each other like the two crossing strokes of the letter X, which represents the number 10. The direction of the strokes is of no consequence, provided that they cross each other. Thus the surface of a file may be said to be decussated, and the same term may be applied to the "cross-hatching" of line engravings, and to the figure #, which idle schoolboys are fond of drawing on their slates when they ought to be employed on some more useful study.

If the reader will now refer to the illustration, he will see that the term "decussata" is very appropriately given to this shell, the surface being crossed by narrow furrows running nearly at right angles to each other. The colour is pale orange-brown, with more or less red, according to the locality in which the shell is found. The most highly-coloured specimens are obtained from the shores of the Mediterranean, where they are used for food. It is generally found in the mud, at such a depth that the dredge can seldom touch it, and it must therefore be dug out with a spade. At page 48, fig. 1, is shown a distorted variety of this shell, the deformity being caused by its penetration into some hard substance.

At fig. 12 of the Plate IV. is shown the LITTLE CARPET-SHELL (*Tapes pullastra*). This shell appears at first to be nearly smooth, but when examined closely it is seen to be covered with grooves arranged like those of the last-mentioned species, but so fine and delicate that they look as if drawn by the point of a needle. It is a small species, rarely exceeding an inch and a half in length. The colour is dirty white outside and polished white within, mostly diversified with a large violet spot at the end. As is the case with the Grooved Carpet-shell, this species is often

distorted in form by boring into hard substances, and a figure of such a deformed shell is given at page 48, fig. 2.

The large and conspicuous figure at Plate IV., fig. 3, represents the SMOOTH CYTHEREA (*Cytherea chione*), the only British example of its genus. This handsome shell can at once be recognised by its shape, its smooth, chesnut surface, banded with a paler hue, and the boldly-shaped muscular depression of the interior, with its deep pit at either end. This structure is well shown at page 48, fig. 5. Sometimes this fine shell measures more than three inches in length, though two inches and a half is the usual average. It is seldom picked up, on account of its love for deep waters, but is obtained by means of the dredge, mostly off the western and southern coasts of England.

The animal, which is also shown, is a good example of the group to which it belongs, with its large, powerful foot, and its slightly diverging siphons.

We now come to the true Venus-shells, several of which are inhabitants of the British shores. The first on our list is the BANDED VENUS (*Venus fasciata*), which is represented on Plate IV., fig. 1, and which may be known by the bold ridges which traverse its surface, and the broad, pale bands that run from the hinge to the edge, widening as they go. It is a small species, being represented of its natural size, and is thick, solid, and very heavy in proportion to its size. Its colour is extremely variable, taking every tint from orange to brown, and the size and number of the pale bands differ in almost every individual. Inside, it is white, and generally has an orange-brown mark running from the hinge to the end of the shell. It is a very common species.

A strong contrast to the Banded Venus is found in the WART VENUS (*Venus verrucosa*), Plate IV., fig.15.

This shell is still heavier and more solid than the preceding, and is at once known by the very deep furrows that traverse its exterior, and are irregularly broken so as to produce the appearance which is expressed in its popular name. The colour is usually pale-brown, with a little red here and there, and the inside is generally white like white porcelain. At page 48, fig. 8, is drawn the inside of this shell, for the purpose of showing the great thickness of the shell, the wart-like protuberances into which the deep grooves are fashioned, and the form of the muscular depression. This shell is usually found on our southern shores.

At Plate IV., fig. 2, is seen the Striped Venus (*Venus striatula*), a small species, about an inch in length, which has caused great discussions among entomologists. This shell is deeply furrowed, but the grooves are narrow, closely set, and look as if they had been made by taking a needle, holding it diagonally, and "scoring" the shell with its point. Its colour is usually of a very pale grey-brown, diversified with several broad pale bands, which are drawn over the shell from the beak to the edges. It is a very common shell, and is thrown up in large quantities by the tide.

Before leaving these shells, I may mention that the well-known "wampum" of the North American Indians is made from one of these shells, *Venus mercenaria*, which we may therefore call the Wampum Venus. The empty shells are thrown on the shore, and are bored and fashioned into necklaces, the rarity of the shell giving a value to the ornament.

CHAPTER VI.

THE RAYED ARTEMIS—MYTHS AND SHELLS—STRENGTH OF THE ARTEMIS—A CURIOUS SPECIMEN—THE SMOOTH ARTEMIS—ORIGIN OF ITS NAME—SURFACE OF THE SHELL—THE ORPHAN-SHELL: A ZOOLOGICAL ENIGMA—LOCALITIES WHERE IT IS FOUND—DIFFERENCES BETWEEN SHELLS—THE LITTLE CIRCE-SHELL—ITS VARIABLE FORM AND COLOUR—THE FURROWED ASTARTE; HOW DISTINGUISHED—LOCALITIES OF THE SPECIES—THE FLAT ASTARTE-SHELL—THE HEART-SHELLS—THE ONLY BRITISH SPECIES—THE HEART COCKLE; ITS PECULIAR FORM—A NATURAL ANCHOR—THE TRUE COCKLES; ORIGIN OF THEIR NAME—THE EDIBLE COCKLE, AND ITS CURIOUSLY FRINGED TUBES—THE RED-NOSE COCKLE; ITS POWERS OF LEAPING—VALUE AS AN ARTICLE OF FOOD—METHOD OF PREPARING IT—THE BANDED COCKLE AND PIGMY COCKLE—HOW TO DISTINGUISH THEM—THE NORTHERN LUCINA—SHAPE AND USE OF THE FOOT—THE KELLY-SHELLS—DIFFICULTY OF IDENTIFYING THEM—THEIR FOOT, AND MODE OF PROGRESSION—THE LITTLE MULLET-SHELL—ORIGIN OF ITS NAME—ITS DIMENSIONS AND LOCALITY—THE GLOBOSE KELLY-SHELL—ITS GENERAL HABITS—LOCALITIES WHERE IT IS FOUND—ITS COLOUR—THE SHINING KELLY-SHELL—HOW TO DISTINGUISH IT—THE SCALY COIN-SHELL—ITS REMARKABLE FORM, COLOUR, AND SURFACE—FORM OF THE ANIMAL—ITS FRINGED MANTLE—THE CONVEX COIN-SHELL—ITS WONDERFUL COLOURING—THE WHITE WEASEL-SHELL—ITS CURIOUS HABITS—FORM AND COLOUR OF THE SHELL AND ITS INHABITANT.

At Plate IV., fig. 13, is given a figure of the Rayed Artemis (*Artemis exoleta*). All the individuals of this genus belong to the Venus-shells; and the classical reader will not fail to remark, that most of the shells which belong to this large group are either called by the name of Venus, or by one of the many local names by which that deity was anciently known, or by the name of some other mythical goddess. In all the Artemis-shells the hinge is remarkably powerful, being strengthened by three stout diverging teeth in one valve and four in the other.

The Rayed Artemis is necessarily drawn on a very small scale, inasmuch as a full-grown specimen would occupy half the plate if drawn of its full size. In

substance it is thick and solid and weighty, and is capable of enduring much rough usage without suffering much damage. A proof of its strength may be found in the fact that a specimen now before me has lain in the sea for so long a time after the death of the animal, that the inside as well as the outside is covered with the tubes of the common triquetra; yet the shell is in thoroughly good condition, the hinge-teeth, the muscular impression, the grooved surface, and the alternate pink and cream coloured rays, being as perfect as if the animal had only just been removed from the shell.

It is a rather pretty shell, the exterior being always of a pinky hue, sometimes fading to cream colour, and being diversified with broad, widening bands of white, as is seen in the illustration. It is very plentiful on most of our coasts, and is found at various depths. At page 48, fig. 6, is shown the inside of one of the valves, with the strong hinge-teeth and the muscular impression.

The only other British species of this genus, the Smooth Artemis (*Artemis lincta*), is shown at fig. 4, together with the curiously-formed animal.

This is a smaller species than the last, from which it may easily be distinguished by the greater smoothness of its surface, and the absence of the beautiful radiating bands. It is by no means a striking shell at first sight, though a close examination will show that the exterior is covered with innumerable concentric lines, drawn so delicately and closely together that they are hardly perceptible except when viewed with a magnifier. The colour is always dull, and in the specimen from which the illustration was drawn it is very pale creamy grey.

The shell which is represented at Plate IV., fig. 11, has sadly puzzled the systematic conchologists, some of whom thought it to be a Venus, others an Artemis,

and others a Lucina. As, however, it disagrees in some points with all of these shells, it is placed in a genus by itself, and is called Lucinopsis, because it looks like a Lucina. We will call it the ORPHAN-SHELL (*Lucinopsis undata*).

Some persons say that this shell is inelegant in shape, but I cannot agree with them, thinking that its outline is as pleasing and its curves as graceful as those of any other shell in the British seas. The surface is a very pale fawn-colour, fading to white on many parts, and is traversed by many concentric lines, which are nearly as fine as those of the Smooth Artemis, but which are more conspicuous, on account of the ridges which traverse the shell in the same direction as the lines.

It is a fragile shell, and, although it is very plentiful, is seldom found in a perfect condition. Sometimes it may be seen flung upon the shore after a violent storm, and in that case the animal may be taken alive. As may be seen by reference to the illustration, the siphons are slight, and only protrude to a short distance from the shell. At page 48, fig 4, is drawn the inside of the valve, in order to show the peculiar teeth and the muscular impression.

If the reader will look at the illustration on page 48, and refer to figs. 3, 4, 5, 6, 8, he will see that the line of the impression is notable for a deep bay, or, in scientific terms, the "pallial impression is deeply sinuated;" but if he will then examine the remaining figures, he will see that the line of the impression is simply curved, without any bay. As this fact proves that the animals which form the shells must be of different shapes, it has afforded to conchologists a reason for making them into a separate family, in spite of the resemblance of the shells.

Here I may mention, that in illustrations the distinctive marks, such as the scars, impressions, &c., are much more clearly defined than in the actual speci-

men. For example, in the shell which we are now examining (*Cyprina Islandica*), one valve of which is shown at page 48, fig. 7, a novice would fail to perceive the peculiar form of the impression, although to an accustomed eye it is marked with more than ordinary decision. In order to follow this all-important line, the shell must be held obliquely to the light, and then turned about, so as to indicate the course of the line by the different reflection which is cast from it.

The teeth, too, and the form of the beak, are necessarily more distinct in the illustration than in the actual object, because the artist endeavours to mark the peculiar characteristics as strongly as possible, while in the real object the eye is often distracted by the multitude of other points, such as colour, reflections, and projections, and finds a difficulty in discriminating between them.

The Cyprina-shells are common enough, for they are tolerably plentiful in point of numbers, and lie in places where they can easily be detected. The Iceland Cyprina is a stoutly-made shell, attaining considerable size, sometimes being as much as five inches in length and scarcely less in breadth. The surface is covered with a strong membrane of a dark olive-brown colour, which clings tightly to the shell, and cannot easily be removed. When, however, it is flaked off, the cream-white shell is seen beneath. The whole surface is covered with fine concentric lines, and a few spots of darker brown are scattered in irregular bands. It is most plentiful on the northern coasts of England, though it is found on all our shores, sometimes being taken at very low tides by the hand in a living state.

A figure of the perfect shell, together with the inhabitant, is given in Plate V., fig. 3.

At Plate IV., fig. 5, is drawn of the natural size a little shell which must be sought by the aid of the dredge, and which, since the use of that instrument

has become so general, has lost its character for rarity.

The scientific name for this species is *Circe minima*, which we may translate as the LITTLE CIRCE-SHELL. To distinguish this shell by means of colour is impossible, as it is so variable that scarcely two specimens are found exactly alike, their outer surfaces being sometimes pure white, sometimes lilac, sometimes brown, sometimes pale pink, and often covered with spots and blotches of other hues. The specimen now before me is almost entirely pale dun, enlivened by a redder hue which marks many of the tiny ridges that surround the outer surface of the valves. The best mode of identifying this shell is by the teeth and impressions, which are seen at page 48, fig. 11; the right-hand figure being drawn of the natural size, in order to show the form of the impressions, and the left-hand figure being much enlarged, to show the hinge and threefold teeth.

Another of the innumerable titles by which Venus was known designates the little group of shells which comes next on our list. At Plate IV., fig. 6, is a portrait of the FURROWED ASTARTE-SHELL (*Astarte sulcata*), together with the animal which formed it. The animal is small, not exceeding the valves in size, and its siphon-tubes do not project beyond the edges of the shell. The foot, however, is tolerably long, and projects freely beyond the edge.

Although an extremely variable species, both in form and colour, the Furrowed Astarte may be recognised by the alternate ridges and grooves which are drawn over its entire surface, and by its general convexity. The ridges are remarkably bold, and very much resemble the grooving upon a boy's pegtop. Another peculiarity is easily seen as soon as the side of the shell is inspected. If the reader will refer to page 48, fig. 9, he will see that a peculiar grooving or "crenation" runs round the inside edge, being, in-

deed, so strongly marked, that it can be detected by touch as easily as by sight.

This is a small shell, seldom exceeding an inch and a half in length. It is found on all parts of our coast, frequenting, as do most of its allies, the spots where sand and mud are mixed. It must, however, be sought with the dredge, as it is seldom found in less than thirty or forty feet of water.

Another species, the FLAT ASTARTE-SHELL (*Astarte compressa*), is represented at Plate IV., fig. 8. It may be known by the flatter form, the yellow-brown colour of the membrane with which the shell is enveloped, the smooth inner edges of the valves, and the sharp, prominent beaks. Perhaps there is no shell which is more variable than this species; and even the most accomplished conchologists are forced to rely for their description on negative rather than positive characteristics. It is a very small species, seldom more than half an inch in length. It is an useful species for the beginner, as the scars and impressions are so boldly marked that their shape is distinguishable at a glance.

We now come to those remarkable bivalves which are popularly called Heart-shells. The best known species, the common HEART COCKLE (*Isocordia cor*), is shown at Plate IV., fig. 21, as it appears when in a living state.

There is only one British species of this well-marked group, and the peculiar formation of the shell is so decided that it cannot possibly be mistaken. The shell is thick, stout, solid, and weighty in proportion to its size, and is easily known by its rotund shape and the manner in which the beaks are curved. In order that the reader may be able to recognise this portion of the shell, a figure of the boldly-curved beaks is given in the accompanying illustration, fig. 8. Immediately above this figure is drawn another, which represents the inside of one of the valves, in order

to show the rounded shell and the muscular impression.

The colour of the Heart Cockle is rather variable, owing to the membranous covering or "epidermis" in which it is enveloped, and which is of various shades of yellow and brown. If this be removed, the shell is seen to be white, traversed by complicated patterns of reddish dun.

Although the two valves can be closed so tightly that sufficient water is retained between for moistening the breathing apparatus when the creature is removed from the water, and so keeping the animal alive for several days, it can use its small but powerful foot to great advantage. This portion of the animal answers the purpose of an anchor, and by being buried in the mud and sand, holds the shell so tightly in its place, that even the storm-lashed waves cannot tear it from its hold. Moreover, storms have little effect in the depths where the Heart Cockle best loves to dwell; and accordingly, large and handsome specimens may be obtained by a judicious use of the dredge.

By an easy transition, we now come to the true

Cockle-shells. The Cockles form a very large group, and it is worthy of notice that the heart-like shape which characterises the generality of the family has given rise to the scientific name of Cardiadæ, or Heart-shaped Shells, by which they are scientifically known. At least two hundred species of Cockles are known, and the researches of travellers are yearly increasing the numbers of this important group.

The best-known species is the Edible Cockle (*Cardium edule*), which is so plentiful on our shores, and is so familiar as an article of diet. A drawing of the interior of the shell is given at page 59, fig. 3; and at 3* of the same illustration is seen the deeply-fringed termination of the tubes.

A less-known species, the Red-nose Cockle (*Cardium rusticum*), is shown at Plate IV., fig. 19. Here are seen the shell, the small siphon-tubes, and the large foot which answers so well as an anchor. This part of the body is of a bright scarlet colour, and in consequence of its hue and shape, has earned for its owner the sarcastical title of Red-nose. It is a powerful organ, enabling its owner to leap to a considerable distance. In hue and polish it much resembles a piece of common red sealing-wax. Like the Edible Cockle, this species is much used for food, and when properly cooked is very excellent for the table, as I can testify from personal experience. Care, however, must be taken in cleansing the animal thoroughly, by long immersion and thorough washing in spring-water, as an uncleansed cockle is gritty and very disagreeable to the teeth.

At fig. 17 is shown a single valve of the Banded Cockle (*Cardium fasciatum*), a very little species, rarely exceeding half an inch in length, and having very thin and fragile valves. It derives its name from the wavy brown bands which are drawn upon the white shell, as shown in the illustration.

Another small species, the Pigmy Cockle (*Cardium*

pygmæum), is shown at Plate IV., fig. 16. This shell is rather smaller than the Banded Cockle, and may be distinguished by the absence of the brown bands, the nearly triangular form, and the solidly-made shell. It is mostly found on our southern shores, just below the line of low-water.

We now come to a large group of shells, called the Lucina-shells. They are scattered over the greater part of the world, but are found most plentifully in the hot and temperate seas, residing upon sand mixed with mud. None of them have projecting siphon-tubes.

A good example of the typical genus, the NORTHERN LUCINA (*Lucina borealis*) is given at Plate IV., fig. 18, in order to show the exterior of the shell; and the interior is seen at page 48, fig. 10. As will be immediately noticed, the hinder muscular scar is large, and very long in proportion to its width, and the impression is without any bay. The foot of this species is very long and slender, and probably answers as an anchor whereby the animal can fix itself in the sand. The colour of the outside is white, but as the valves are covered with a yellow or grey membrane, the real hue does not at first appear. Inside, the shell is white, and there are two hinge-teeth in each valve.

The group of shells which now comes before us is small, so variable in form and colour at different periods of their lives, that identification is by no means an easy matter, and mostly having very fragile shells.

When the animal can be obtained with the shell, to identify it is not so difficult, as the distinguishing characteristics of the animals are better defined than those of the shells. They are remarkable for having but one siphonal opening, and they all possess a grooved foot, from which proceeds the remarkable silken cable which is technically named the "byssus.'

A very good example of this byssus is to be found in the common edible mussel. By means of the foot it can proceed at a tolerable pace, not gliding smoothly onwards like the snails and slugs, but pushing the foot forwards, attaching it to some object, then drawing itself by the contraction of the foot, and repeating this process until it has arrived at its destination.

This family is named Kelliadæ, being a barbarised form of the Irish name, O'Kelly. I have so often expressed my opinion upon this increasing system of nomenclature, that I need not repeat it here.

One of these shells is represented at Plate IV., fig. 20. The scientific name is *Turtonia minuta;* but we will term it the LITTLE MULLET-SHELL, because it is commonly found in the stomachs of mullets. Here I may remark, that the experienced zoologist always opens the stomachs of fish which he has caught, in order to see what they have been eating. In many cases the examination not only proves the nature of the diet, but is the cause of discovering specimens which could scarcely be found in any other way.

This is a very tiny shell, so small, indeed, that the drawing is necessarily magnified in order that the form might be shown. Few specimens exceed a twelfth of an inch in length, and many fall short of this measurement. In order to give a correct idea of the true length of this shell, I may mention that the capital letter O is about the size of an average specimen. The shell is exceedingly thin, purple-brown in hue, pale towards the cap, and dark at the beak, and so delicate as to be semi-transparent. It may be found by looking among the roots of corallines and other algæ.

The inside of a much-magnified valve is shown at page 59, fig. 5, in order to show the peculiar form of the impression of the two rounded scars.

The typical genus of these shells is *Kellia*, which we must simply translate as Kelly-shells. One of

their peculiarities is, that they have one efferent aperture instead of the corresponding siphon-tube, and that the place of the other tube is taken by a prolongation and folding of the mantle, as may be seen in Plate IV., fig. 10, which represents the GLOBOSE KELLY-SHELL (*Kellia suborbicularis*). The specimen is represented as it appears when suspended by its byssus, which is a very slight thread, so delicate, indeed, as to be almost invisible in water, although it is perfectly capable of bearing the weight of a creature so small. It can crawl about at will, and can move in any direction, the tongue-like flexible foot adapting itself to the requirements of its owner.

This species may be found in various localities, but almost invariably in some sheltered situation, such as the crevice of a rock, a hole in a stone, among the twisted roots of sea-weed, or even in the hollows of bivalves and other shells whose rightful inhabitants have perished. In colour this pretty little shell is white and nearly transparent, and in size it is rather more than the third of an inch in length. A figure of the inside of a valve is given at page 59, fig 4, in which may be seen the resemblance to fig. 5.

Another species of this genus, the SHINING KELLY-SHELL (*Kellia nitida*), is shown at the same page, fig. 1; and just below is given a much enlarged view of the hinge, in order to exhibit the long single slanting tooth. The shell is white, but when quite fresh is ochrey yellow, owing to the membrane with which it is covered. This, however, disappears after a time, and then the shell appears not only white, but semi-transparent.

There is an allied genus of shells, which are called by the name Lepton, which signifies a flat coin; we will therefore term them Coin-shells.

The most remarkable of the British species is shown at Plate V., fig. 4. This is the SCALY COIN-SHELL (*Lepton squamosum*), so called from the minute

tubercles with which the whole surface is covered. This most remarkable shell is nearly as flat as a shilling, very delicate, very transparent, very brittle, and very white. On the outside it is rough, and when examined through a lens, the roughness is seen to consist of a vast number of tubercles, very much resembling shagreen. The inside of the shell is seen at page 59, fig. 2.

If the reader will refer to Plate V., fig. 4, he will see that the mantle of this species is very large, and edged with a deep fringe, which passes beyond the edges of the shell in every direction. The long projection on the left hand is not the foot, but merely one of the filaments of the fringe, which appears, according to Mr. Alder, to act as a feeler, and to indicate to the animal the course which it is pursuing. The large foot may be seen below, acting much like the corresponding organ in the snail.

At Plate V., fig. 4.**, is given a single valve of another species, the CONVEX COIN-SHELL (*Lepton convexum*), a creature which has gained its name from the slight convexity of its shell, in which it differs much from the preceding species. The shell itself is white, but when the animal is living, the valves are enveloped with a membrane which gives out radiant hues as of the opal, the colours changing from red to green, like shot silk.

There is one genus of the shells which is named *Montacuta*, in honour of Montagu, the celebrated naturalist. The hinge of this genus is drawn at page 59, fig. 7, in order to show the diverging teeth.

The last of this group are those curious shells which were fancifully called by a name which signifies Weasel-eye, and which we will therefore call Weasel-shells.

At Plate V., fig. 1, may be seen a specimen of the WHITE WEASEL-SHELL (*Galeomma Turtoni*), in the remarkable position which it loves to assume. Most

bivalves prefer to remain with closed valves, or at all events only open them a very little way; but the Weasel-shell lays them widely open, and being anchored by its byssus, lies in the curious attitude which is shown in the illustration. A separate valve is shown at fig. 2 of the same Plate. Both the shell and animal are pretty, the first being pearly white, and the second remarkable for a double row of round, eye-like spots upon the edges of the mantle. It can walk with some speed.

This pretty shell may be found on the southern coasts of England, adherent to the roots and fronds of the large sea-weeds, or concealed in the crevices of rocks. It is represented of its natural size.

CHAPTER VII.

GRADATION OF MOLLUSCS—SOME FRESH-WATER SHELLS—THE NUT ORB-SHELL—ITS FORM, COLOUR, AND LOCALITY—THE GLOBOSE ORB-SHELL AND THE LAKE ORB-SHELL—FORM OF THE ANIMAL—THE CAPPED ORB-SHELL—ORIGIN OF ITS NAME—THE PEARL-SHELLS—WHY SO CALLED, AND WHERE FOUND—THE RIVER PEARL-SHELL—ITS FORM AND COLOUR—THE ASHEN PEARL-SHELL, AND ITS SLIGHT CAP—THE FRESH-WATER MUSSELS AND THEIR AFFINITIES—THE PAINTER'S MUSSEL—USE OF THE SHELLS—THE SWAN MUSSEL—ITS VARIABLE COLOUR—POSITION IN RIVERS—NUMBER OF ITS YOUNG—THE CHAMBERED MUSSEL—DERIVATION OF ITS NAME—ITS RAPID SPREAD THROUGH ENGLAND—ITS FERTILITY—THE PEARL MUSSEL—VALUE OF ITS PRODUCTS—THE EDIBLE MUSSEL—ITS FORM, COLOUR, AND GENERAL HABITS—VALUE OF THE MUSSEL TO THE FISHERMEN—THE MUSSEL AS USED FOR FOOD—POISONOUS MUSSELS—CURIOUS SYMPTOMS—AN INSUFFICIENT THEORY—THE HORSE-MUSSEL—ITS COLOUR AND HABITS—THE TULIP HORSE-MUSSEL—ORIGIN OF ITS NAME—THE BEARDED AND PHEASANT HORSE-MUSSEL—HOW TO DISTINGUISH THEM—THE CRENELLA-SHELLS—REASON FOR THEIR TITLE—THE GREEN CRENELLA-SHELL—ITS SMALL SIZE—SINGULAR HABITATION—THE MARBLED CRENELLA—A REMARKABLE HABIT—THE BLACK CRENELLA, AND ITS HABITAT—THE GROOVED CRENELLA—ITS MINUTE DIMENSIONS AND DELICATE SHELL.

As was mentioned in the Preface, the gradation of molluscs is so regular, that we must include a few of the fresh-water species, in order to avoid breaking the connection too abruptly. Not only, for example, do the shells of the present group resemble in many important points those of several species which have already been mentioned, but several of them live so close to the mouths of rivers that it is hardly possible to say whether they belong to the aquatic or marine group of shells. This group is called Cycladæ, a name which may be literally translated as Orb-shells.

At Plate V., fig. 7, is seen the NUT ORB-SHELL (*Cyclas rivularia*), a small shell, very seldom an inch in length, and yet the largest of the British species. It is olive-

brown in colour, the olive becoming plainer towards the hinge. It lives buried in the mud, and prefers slow streams and lakes to swift rivers. It is an active species, walking and climbing with ease. The Thames is a favoured locality with this shell.

Another species, the GLOBOSE ORB-SHELL (*Cyclas cornea*), which is represented at Plate V., fig. 8, is a stouter, thicker, and more globose shell than the preceding. In colour it is somewhat darker, and the deeper brown of its general hue is relieved by the very narrow yellow bands which traverse the shell at wide intervals. The hinge of this species is shown at page 59, fig. 10.

At Plate V., fig. 9, is shown the LAKE ORB-SHELL (*Cyclas lacustris*), which is notable for inhabiting still water. Its surface is ashen or yellowish grey, with some rather indistinct rays towards the edge.

In order to exhibit the form of the animal, a figure of another species, the CAPPED ORB-SHELL (*Cyclas caliculata*), is given at fig. 5.

This little shell derives its name from the curious appearance of the beaks, which look exactly as if a little cap of shelly matter had been placed artificially upon them. The specimen in the illustration is drawn of the ordinary size, and exhibits the peculiar cap, the foot, and the siphonal tubes. Its colour is rather variable, but is usually either brownish or reddish, and in the latter case the beaks are decidedly black. It is found in lakes and ponds, and although it is scattered over the greater part of England, is not very common in cabinets, because it requires much care in the shell-hunter.

If the reader will carefully search the ponds, lakes, still rivers, and ditches, he will probably find among their inhabitants some of the pretty little Pearl-shells, called scientifically Pisidia. Indeed, there is no better or safer method of learning zoology than adhering to one spot, and exhausting its living contents, of what-

over kind they may be. The number of species that are to be found in a single meadow, copse, or garden, is really astonishing; and by the time that they have been identified, no small knowledge of natural history will have been gained—knowledge, too, of a practical as well as theoretical character, and which therefore takes a far stronger hold of the mind than that which is merely gained from books.

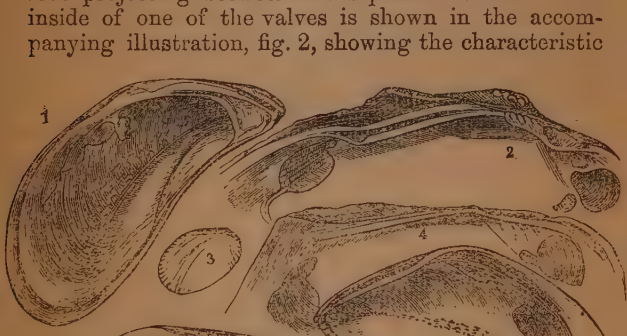
At Plate V., fig. 4*, is a valve of the RIVER PEARL-SHELL (*Pisidium amnicum*), drawn of the natural size. All the Pearl-shells are very small, as may be gathered from the fact that the present species is by far the largest of them which inhabits British waters. This shape alters with age, for when young it is much flatter than when it has arrived at full age. The colour, too, is slightly variable, though more in appearance than reality. When in perfect condition, the shell is a delicate grey, with a slight tinge of yellow, and, owing to the extreme thinness of its structure, is decidedly translucent. In most instances, however, a coating of darkly-coloured substances disfigures the delicate yellow-grey, and renders the shell nearly opaque. Sometimes the ashen-grey and yellow are in alternate bands, the former tint being always nearest the beak. The surface is covered with delicate lines, drawn consecutively and rather irregularly.

This is by no means a rare shell, though it is not very often found, owing to its habit of sinking itself almost entirely under the mud. The hinge is shown at page 59, fig. 9. The animal has a very large and long foot, and one siphon-tube.

Another species of this genus, the ASHEN PEARL-SHELL (*Pisidium cinereum*), is shown at Plate V., fig. 6. It is flatter than the preceding species, and is of a nearly uniform ashen hue, owing to the colour of the epidermis or membrane with which the valves are covered. In some specimens the beaks are slightly capped, like those of the Orb-shell already described. The figure is drawn of the natural size.

We now come to the Fresh-water Mussels, a group which is noticeable as showing the intimate connection that exists between marine and aquatic shells. The first on our list is the PAINTER'S RIVER MUSSEL (*Unio pictorum*), so called because the shells were formerly much in use for containing the more delicate colours of painters. Even at the present day, silver and gold are preserved in these shells for the use of artists and illuminators in water-colours.

A specimen of this shell is shown at Plate V., fig. 11, where the shells are drawn as they often appear in the living state, namely, slightly open, with the large foot projecting between the separated valves. The inside of one of the valves is shown in the accompanying illustration, fig. 2, showing the characteristic



hinge and scars. The exterior of the shell is covered with an epidermis of a greenish yellow, running in bands; and the interior is pearly white, with a slight tinge of blue.

At Plate V., fig. 10, is shown one of the commonest species of these shells, namely, the SWAN MUSSEL of our rivers, lakes, and ponds. Its scientific name is

Anodon cygnæus. It may easily be distinguished from the preceding shell by the hinge, which is without a tooth, as may be seen at page 69, fig. 4.

To describe precisely the shape or colour of this shell is an impossible task, as it is as variable a shell as can well be imagined, differing according to age, locality, or other causes. This shell is a great nuisance to fresh-water bathers who cannot swim, as it has a way of lying in the bed of the river, with its shells partially open, and the sharp edges of the valves upwards, so that the feet are cut as with a double-bladed knife. The shell being of a nacreous character on the inside, and decorated on the exterior with a richly-coloured epidermis, can be made into a very beautiful object by means of careful polishing. In my younger days, I used to take great numbers of this handsome shell, and polish them in various ways, sometimes taking off all the epidermis, and sometimes leaving it in stripes and patches.

It is a very prolific species, as may be seen by opening a few specimens in the spring and summer. Within the valves lie a vast number of young, all minute, but with shells of the most delicate structure and almost perfect transparency. The average size of a fine shell is four or five inches in length, but in favourable localities they have been known to reach the extraordinary length of six inches, and to be three inches in width.

One of the best examples of a mollusc which is equally at home in fresh, salt, and brackish water, is to be found in the CHAMBERED MUSSEL (*Dreissena polymorpha*), which is shown at Plate V., fig. 14, as it appears when hanging by its byssus.

This remarkable mollusc has taken England by storm, and, like the rat, has spread so rapidly through the country into which it was casually imported, that it has become in many cases far more common than the original inhabitants. Although a fresh-water

species, it can endure a large admixture of salt, and certainly for a time even endure existence in the sea. As far as is known, it came to this country by adherence to the bottoms of ships in dock, clinging to them while they crossed the sea, being scraped off when they reached English docks, and then taking up their habitation in the waters into which they were flung.

It gets into the most unexpected situations. I well remember my astonishment at finding, some twenty years ago, a quantity of the Chambered Mussel clinging to a drooping branch of the weeping willow that bent its graceful twigs into the Cherwell. I was tolerably familiar with the ordinary river shells, but these molluscs puzzled me exceedingly. The fact was, they had travelled up the canal, perhaps adherent to barges, and had been washed down into the little drain-streams that supply the river with much of its contents. Sometimes they get into the pipes of water-companies, and make their appearance in cisterns, the basins of fountains, and other unexpected places.

Wherever it does appear, it never fails of attracting attention, so conspicuous is it, and so great are its numbers. In many rivers that are adorned by willows, the roots extend into the water in long tufts of delicate filaments that are called water fox-tails by the children, and that very much resemble their prototype. To these roots the Chambered Mussel is fond of clinging, and in many places is so plentiful that it may be taken out by the handful. I have often lifted a group which would fill an ordinary hat, and in more favourable spots even larger assemblages may be found.

The name of Chambered Mussel is derived from the curious structure of the shell. If the reader will refer to page 69, fig. 1, he will see that towards the beak of the shell a plate of nacreous substance stretches across the shell, so as to form a kind of chamber. This structure is seen in both valves. Perhaps the

reader may not be aware that some of the Fresh-water Mussels are capable of producing pearls, and that one species, *Unio Margaritiferus*, or the PEARL MUSSEL, is so prolific in these curious productions, that regular fisheries were at one time established. They were not particularly productive, inasmuch as only one per cent. of shells produced a pearl, and only one per cent. of the pearls was worthy of preservation.

Although the above-mentioned species has the honour of being considered the pearl-producer of Britain *par excellence*, and is mythologically supposed to have furnished pearls for the British crown, other species possess the same power, though perhaps in a more limited degree. Even the Chambered Mussel can produce pearls on an emergency, and the specimen which has been depicted by the artist has done its best to produce a genuine pearl. The specimen from which the drawing is taken is now before me, and shows the inchoate pearl projecting from the interior of the shell, dull in colour, irregular in form, totally worthless in the market, and looking very much like a molluscan wart. Still, imperfect though it may be, and useless to the jeweller, it is valuable to the conchologist, as affording a clue to the manner in which true pearls are formed.

We now come to the true Mussels, the typical example of which is the well-known EDIBLE MUSSEL (*Mytilus edulis*), which is so familiar to us in the fishmongers' shops and the baskets of the costermongers. A figure of this species is given in Plate V., fig. 12, where may be seen the large siphonal aperture above, and the long narrow foot below, with the byssus-threads projecting from it. Everyone who has visited the rocks at the sea-side, must have seen these creatures hanging together in such masses that their shells blacken the white rock, and render it quite invisible at a little distance. The colour of the shell is generally a very deep violet, which is partially

obscured by a thin olive-brown epidermis, but which can be brought out in all its beauty by a little rubbing with fine emery-powder.

This is one of the most important molluscs which the sea produces, even the oyster being scarcely of less value to the nation; for it is largely used as food, being palatable, mostly nourishing, and sold at a cheap rate. Its chief use, however, is for bait, its attractive properties being well known to all those who have had practical experience of sea-fishing. No one need be in want of a bait as long as he can find a Mussel; and even when the lug-worm is employed, the Mussel is often added to tempt the fish more powerfully. The cod-fishers depend almost entirely on this mollusc for success in their labours, and for their service alone the Mussel is bred by millions in preserves technically named "gardens."

The details of this animal and its economy are extremely interesting; but as space is valuable, and a slight sketch would occupy many pages of our fast-waning space, only a very few particulars can be added.

Generally, the Mussel is a wholesome and nutritious article of diet. I have made many an extemporised luncheon upon this mollusc, opening one shell by means of another, just as one walnut is cracked with another. It is equally good when stewed, fried, scalloped, or otherwise cooked; but it has one drawback: at distant intervals a batch of Mussels turns out to be deleterious, and produces most unpleasant symptoms in the consumers. They are attacked with a singular variety of symptoms: they have nettle-rash breaking out all over the body with astonishing rapidity; they become giddy, are seized with a kind of fit, and then fall insensible. Sometimes they are partly paralysed, and sometimes they are seized with asthma. In many cases, the symptoms have become so aggravated that the sufferer has been unable to bear up against them, and has died.

And the most remarkable part of the business is, that no one knows the cause of these symptoms, no one knows how to detect the poison-bearing Mussels, and no one precisely knows how to give relief from the suffering which this mysterious poison inflicts. The popular idea—and it is certainly a specious one—is, that the deleterious Mussels are those which have been scraped off the copper bottoms of ships, and have been sold by the labourers in the docks. But as there are many instances where this remarkable disorder has proceeded from Mussels that were undoubtedly taken from rocks or out of "gardens," this theory falls to the ground. At page 69, fig. 6, may be seen a figure of the interior of the shell.

Closely allied to the true Mussels is a group of shells which, from their strong scent and flavour, are not used as food, and are popularly known as Horse-mussels. Their scientific title is *Modiola*. Many zoologists have thought, and in my opinion rightly, that these shells ought not to have been separated from the preceding genus. The byssus which they spin is remarkably strong, and in some species is so large that it acts as a kind of covering or protection to the shell. The best-known British example is the Common Horse-mussel (*Modiola modiolus*), a figure of which is given at Plate V., fig. 17, and an inner view of one of the valves at page 59, fig. 5.

This species is not handsome, the shell being covered with a stout brown epidermis, covered with wrinkles, and with a slight gloss. The byssus of this species is enormously large, and the animal often contrives to weave together such a mass of the byssus-threads, sand, and small stones, that the shell is completely concealed, and its presence would not be suspected by an unpractised eye. It prefers gravel, sand, and mud, and lives so close to the shore that it is easily taken by hand.

Another species of the same genus, the Tulip Horse-

MUSSEL (*Modiola tulipa*), is figured at Plate V., fig. 23, and has derived its popular name from the beautiful colour of the shell, which is decorated with radiating streaks of crimson or violet, much like those on the petal of a tulip. In this species the byssus is extremely small, and in most examples seems to be absent altogether.

There are two other species of British Horse-mussels, which must be briefly noticed on account of some peculiarities in the structure of the animal. One is the BEARDED HORSE-MUSSEL (*Modiola barbata*), which has derived its name from the curiously fringed byssus-threads of the epidermis; and the other is the PHEASANT HORSE-MUSSEL (*Modiola phaseolina*), in which they are smooth on both edges. The former is represented at page 69, fig. 8, and the latter at fig. 7.

We now come to a pretty little group of this large family, called the Crenella-shells, because they are mostly "crenulated" on the hinge-margin. They are all small shells, three-quarters of an inch being rather an unusual length, and the average being about half an inch.

The first on our list is the GREEN CRENELLA (*Crenella discors*). A figure of the interior of a valve is given at page 69, fig. 3, in order to show the peculiarity from which these shells derive their name. It is a small species, a good specimen now before me measuring rather less than half an inch in length. The valves are, however, rather deep. The colour is pale green, and the surface is covered with delicate lines radiating from the beak to the circumference, usually in two well-marked "sets," the one set reaching the other, and being cut short at the point of junction. It is very plentiful on our coasts, and may be found among the roots of various algæ, its pretty shell being hidden in the curious nest which it makes with its byssus and little stones.

Another species, the MARBLED CRENELLA (*Crenella*

marmorata), it represented at Plate V., fig. 19. This shell is scarcely less plentiful than the preceding, if shell-hunters only knew where to look for it. Strange to say, he who wishes to find the Marbled Crenella must dredge up a quantity of Ascidians, especially *Ascidia mentula*, and look in their tough "tests." It is a pretty species, mostly covered with reddish-brown marblings upon a pale-green ground. The surface is decorated with radiating lines, which run in three sets, and not in two, as is the case with the Green Crenella.

A very fine, but rarer species, called from its colour the BLACK CRENELLA (*Crenella nigra*), is drawn at Plate V., fig. 13. The colour, however, is scarcely black, but rather blackish brown, generally with a tinge of olive-green. It is more plentiful on the northern than the southern coasts, and must generally be procured with the dredge.

The tiny GROOVED CRENELLA (*Crenella decussata*) is drawn at Plate V., fig. 19, and is shown of its natural size. Like the preceding, this is a northern species, and is generally found on the Scottish coasts. The shell is very delicate and fragile, and the colour is pale olive, owing to the epidermis with which the white valves are covered.

CHAPTER VIII.

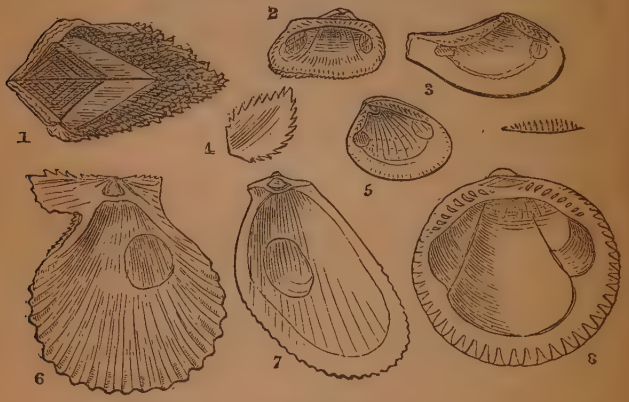
THE ARK-SHELLS—THEIR VARIETY IN FORM AND COLOUR—MODE OF DISTINGUISHING THEM—THE COMMON NUT-SHELL—WHERE FOUND—THE SHINING NUT-SHELL—THE BEAKED LEDA-SHELL—ITS CURIOUS FORM—COLOUR OF THE EPIDERMIS—THE PIGMY LEDA-SHELL—ITS MINUTE DIMENSIONS—LOCALITY WHERE FOUND—THE NOAH'S ARK—ITS SINGULAR FORM—ITS SCULPTURED SURFACE—DIFFICULTY OF FINDING A PERFECT SPECIMEN—DERIVATION OF ITS NAME—THE MILKY ARK-SHELL—THE MOTTLED COMB-SHELLS—FORM OF THE HINGE, AND NUMBER OF THE TEETH—THE WING-SHELLS, AND THEIR CURIOUS FORMATION—THE PINNA—ITS DIMENSIONS AND GENERAL HABITS—MR. COUCH'S ACCOUNT OF THE SHELL—A SINGULAR GUEST—THE BYSSUS—THE OYSTER TRIBE—THE FRAGILE FILE-SHELL—DERIVATION OF ITS NAME—THE GAPING FILE-SHELL—ITS PECULIAR NEST—THE HEART FILE-SHELL—THE VARIABLE SCALLOP—BEAUTY OF THE ANIMAL AND SHELL—THE HUNCHBACK SCALLOP—STRANGE FORMATION—THE MOTTLED SCALLOP—LOCALITIES WHERE FOUND—THE TIGER SCALLOP AND RADIATED SCALLOP—THE COMMON SCALLOP—THE SADDLE OYSTER—SINGULAR STRUCTURE OF THE SHELL—UNEATABLE CHARACTER OF THE ANIMAL—THE PRICKLY SADDLE-SHELL—ITS VARIABLE FORM—THE COMMON OYSTER.

We now come to a curious group, called the Ark-shells. They are extremely variable in form and colour, as may be seen by reference to the examples which are given in the illustration; but they may all be recognised by a glance at the hinge. This part of the shell is mostly straight, and is furnished throughout its whole length with a great number of little comb-like teeth. When the valves are closed, these teeth interlock with each other, and force the shell to open only in one direction.

The first genus of this group is formed by the Nut-shells, so called from their peculiar form and general appearance. The Common Nut-shell (*Nucula nucleus*) is a little shell, rather more than half an inch in length. The true colour of the shell is white, but, in common with all the members of its tribe, its shell is

covered with a thick epidermis, which in this species is dark olive-brown. As the creature lives among sand and mud, the epidermis is apt to become stained, and so to give a false idea of the real colour.

This shell is extremely common in moderately deep waters, and is brought up in quantities by the dredge, or similar sea-scraping instruments. A figure of the Common Nut-shell is given on Plate V., fig. 24. In the accompanying illustration, fig. 5, is drawn the inside of one valve, showing the comb-like teeth along the hinge. The magnified teeth are seen at the side.



Another species, the SHINING NUT-SHELL, is shown at Plate V., fig. 22. This little shell very closely resembles the former, except that the epidermis is much polished, and that, if it be removed, the shell itself is seen to be traversed with greyish rays.

Next in order come the Leda-shells, which may be distinguished from the preceding creatures by the peculiar shape of the shells, which are always more or less elongated. They may further be distinguished by means of the bay in the pallial line. At Plate V.,

fig. 12, is seen the BEAKED LEDA-SHELL (*Leda caudata*), a species whose remarkable form renders it at once recognisable. This remarkable shell is pale olive-green in colour, on account of the epidermis which covers the valves; and the whole surface is covered with little narrow ridges at nearly regular distances. Like several of the last-mentioned species, the Beaked Leda-shell loves the northern parts of the island, and is mostly found on the Scottish shores.

At page 78, fig. 3, may be seen the inside of the Leda-shell; and at fig. 4 is drawn the "sole," if we may use such a term, of its foot, as it appears when flattened and spread for walking.

At Plate V., fig. 15, is drawn a very tiny shell, called the PIGMY LEDA-SHELL (*Leda pygmæa*). This little shell is almost always less than a quarter of an inch in length, and not half that measurement in breadth. Its form is a mixture between the triangle and the oval; the shell is tolerably strong, and is covered with a yellowish epidermis. It is not very common, but may be found on mixed sand and mud, and taken with the dredge. Perhaps its minute dimensions have caused it to be overlooked where larger shells would be at once seen.

We now come to the true Ark-shells, the typical example of which is certainly that strange, quaint-looking species which is called among collectors the NOAH'S ARK (*Arca tetragona*).

In general shape this odd shell very much resembles a trunk-fish; and instead of being rounded like most of the bivalves, it is full of angles, and looks very much as if it had been hastily formed by three pinches of the thumb and finger, and then a sharp blow on a table or other flat surface. The general form of this shell can be seen by referring to one or two illustrations. On Plate V., fig. 16, there is a sketch of the shell in its entire state. Originally, the whole shell is covered with deep grooves and ridges; but these

marks are easily rubbed away, and then the shell presents the appearance which is so well marked in the illustration. At the hinge, the shell is not only flattened, but even pushed inwards, as may be seen at page 78, fig. 1, where this curious formation is shown, as well as the bold ridges of the exterior.

Owing to the ease with which it is disfigured, a perfect specimen is very seldom found. One now before me presents an extraordinary appearance; for the shell is not only worn away in some places, but its substance is much increased in others, by the lepralia and similar creatures that have settled down upon it. The name Tetragona signifies four-angled, and is given to the species on account of its squared form.

Although not among the commonest of the British shells, the Noah's Ark can be found by those who search for it in the right places, namely, in the clefts of submerged rocks, under large stones, and even in the empty shells of other molluscs. Sometimes, when it gets into a cavity through a narrow hole, it grows too large to get out again, and then assumes the most extraordinary shape by coming in contact with the sides of its prison.

There are several British species of this genus, and the inside of one species, the MILKY ARK-SHELL (*Arca lactea*), is shown at page 78, fig. 2.

Another genus of Ark-shells is distinguished by the title of Pectunculus, a name which signifies a little comb, and which is given to it on account of the comb-like teeth of the hinge. We may therefore term this group the Comb-shells. At Plate V., fig. 20, is a drawing of the MOTTLED COMB-SHELL (*Pectunculus glycimeris*). This handsome shell attains a tolerable size, a specimen now before me being nearly two inches in length, and almost as much in width. The entire surface is covered with the most delicate lines, radiating from the beak to the circumference, and

interrupted occasionally by slight concentric grooves. The present specimen, which is that from which the illustration was drawn, is nearly white as a background, and is covered with marblings of rich rust-red, arranged in the peculiar manner shown in the illustration.

At page 78, fig. 8, is drawn the inside of a valve of this shell, for the purpose of showing the peculiar shape of the impressions and scars, as also of the teeth whence it derives its name. The teeth are increased in number by age; but as those in the middle generally fade away as the others are produced, the number is but slightly altered. It can only be obtained by the dredge.

Another family now comes before us, which is scientifically called Aviculaceæ, a name which we may translate almost literally as Wing-shells. They derive their name from the wing-like processes from the hinge. The family is celebrated for producing the well-known pearl oyster; but as the greater number of the species inhabit the hotter parts of the earth, only a few can be found in English seas.

One of them is the Swallow Wing-shell (*Avicula pectinata*), an elegantly-formed mollusc, which looks something like a scallop, with a long, straight, wing-like projection from the hinge. As may be supposed from the usual habitat of these shells, the Swallow Wing-shell is seldom found except on our southern coasts, and even there is not a very common species.

A better known British example is the Common Pinna (*Pinna pectinata*), which is figured on Plate VI., fig. 4. This is the largest of the British shells, the average length of a full-sized specimen being twelve inches, and many attaining still greater dimensions. The Pinna-shells are most plentiful on the southern coasts, where they may be found very near the shore.

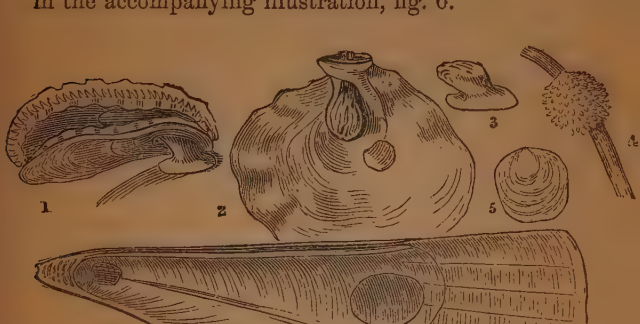
Mr. Couch remarks of these shells, that off Cornwall "they stud the bottom in multitudes, with only two

or three inches of the pointed end inserted into the soil. It is common for the line or hook to become entangled among the shells, and a powerful effort is required to drag them from their attachment, which is only effected by breaking the byssus, or tearing away the ground to which it is attached. In the latter case, a rich harvest of shells is often afforded, but the pointed end of the Pinna is usually broken off by the violence.

"It is perhaps owing to the different degree in solidity of the ground, that the shells living in deeper water are so much less buried than those of which Montagu speaks (*i.e.*, sunk within an inch of the surface); and one of the consequences may be a greater degree of motion in the shell. Montagu observes, that the exposed end cannot be closed by art, but the animal is capable of effecting it, and observation has taught me that this is its method of obtaining food. In its ordinary position this opening is about two inches wide, exposing the contained animal, which occupies but a small portion of the cavity, and seems to offer itself as a prey to the first creature that may choose to devour it. Some fish is thus tempted to enter, but the first touch within is a signal for its destruction. The shell closes not only at the side but top, the latter action being effected by the separation of the pointed ends; and the captive is either crushed to death, or soon perishes from confinement."

It is a remarkable fact that a very little crustacean, popularly called the Pea-crab (*Pinnotheres pisum*), lives permanently within the shells of the Pinna. The same crab is sometimes found in the Horse-mussel, and another species (*Caphyra pectenicola*) inhabits the scallop. The byssus is enormously strong; and in the British Museum may be seen a pair of gloves, apparently woven of brown silk, but which have been made from the byssus of the Pinna. The flesh of the Pinna is edible, but it requires very protracted stewing to make it tender.

The colour of the Pinna is very pale brown, and the surface is extremely variable, sometimes being nearly smooth, and sometimes covered with projecting scales on the ribs. The inside of this shell is shown in the accompanying illustration, fig. 6.



We now come to the Oyster tribe, one of the most valuable groups that the sea affords, and which embraces the scallops, the saddle oysters, and the edible oysters.

The first on our list is a very curious little species, the FRAGILE FILE-SHELL (*Lima Loscombii*). See Plate VI., fig. 5. The File-shells derive their name from the manner in which the outside of the valves is crossed and re-crossed with delicate lines, very much resembling those of the file. In the present species the shell is white, very fragile, closed on one side, and gaping slightly at the other.

On the same Plate, and at fig. 3, is shown the shell of our largest species, the GAPING FILE-SHELL (*Lima hians*); and at fig. 4 is seen the animal in its shell, showing the peculiar gaping form, and its method of surrounding itself with a kind of nest, made of sand

and stones held together with its byssus. A figure of the inside of its shell is given at page 78, fig. 7. The colour is snowy white.

Another species, the HEART FILE-SHELL (*Lima subauriculata*), is shown at Plate VI., fig. 2. It is the smallest of the known British species, and may be easily recognised by its heart-like shape when viewed sideways, and the comparative smoothness of the exterior. All these examples are drawn of their natural size.

We now come to the Scallops, the general form of which is too familiar to need description. Although the greater bulk of these beautiful shells, including the most brilliantly coloured species, are natives of the tropical seas, we have several British species, all of which are pretty, and some are really handsome. Take, for example, the VARIABLE SCALLOP (*Pecten varius*), which is represented in the central figure in Plate VI. No shell is more variable than this, for scarcely any two specimens are alike in colour. It can, however, be distinguished by its numerous bold ribs and the spine-like projections of the exterior. Very rarely a nearly white specimen is found, but it is generally of some shade of red, brown, chocolate, or yellow, and patched with white. The inside of the shell may be seen at page 78, fig. 6.

The animal is very pretty, its edges being furnished with short and long tentacles, between which is set a series of round black objects technically named "ocelli." Like all its kin, this species can project itself rapidly through the sea by alternately opening and closing its valves.

At Plate VI., fig. 11, is a remarkable species, the HUNCHBACK SCALLOP (*Pecten pusio*), shown in its adult state. When it is young, this species has the well-known shape of its kin; but as it increases in age it mostly becomes distorted, and sometimes assumes the remarkable shape which is shown in the illustration.

A specimen now before me has one valve nearly flat, and the other exceedingly deep and round; so that if the two valves were shown separately, very few would recognise them as belonging to the same specimen. Its colour is white, mottled with brick-red.

At Plate VI., fig. 7, is a shell of the MOTTLED SCALLOP (*Pecten striatulus*); and at fig. 8 is shown the animal in its shell, in order to exhibit the beautiful tentacles and ocelli. The shell is brownish-red or chocolate, with numerous white marks; and its substance is so thin that it is very fragile and nearly transparent. It is found on the northern coasts.

Coloured much like the preceding species, the TIGER SCALLOP (*Pecten tigrinus*) may be known by the fact that one of the "ears," or hinge projections, is almost entirely absent. It is very variable in colour, and is notable for being sometimes smooth and sometimes distinctly ribbed.

Another variable and not very common British species is the RADIATED SCALLOP (*Pecten Danicus*), so called from the few bold radiating folds which traverse the shell. The colour is mostly red-brown, speckled with white; and anyone who is fortunate enough to obtain a specimen will easily recognise it from the figure.

Our last example is the COMMON SCALLOP of the fishmongers' shops (*Pecten opercularis*). This well-known species can be recognised by the eighteen or twenty radiating folds of the shell, the nearly equal ears, and the numerous rows of closely-arranged scales with which the surface is covered. Its colour is exceedingly variable.

We now come to the remarkable SADDLE OYSTER (*Anomia ephippium*), which is so curious a being that several illustrations of it are given. It is immediately recognised by its flat lower valve, in which is a large and nearly oval hole, just below the hinge. A figure of this structure is given at Plate VI., fig. 13

Through the aperture proceeds a strong muscular band, which is fixed to a curiously-shaped knob of shelly matter, technically named the "button," and which is capable of passing through the hole, so that by its means the shell is hitched on the button. At page 83, fig. 1, may be seen a side view of the Saddle Oyster, showing the muscular band passing through the aperture and fixed to the button. At fig. 3 is represented the button itself, and at fig. 2 the shell with the button in the aperture.

The shape of the shell alters greatly with age. When young, it is oyster-shaped, as may be seen at fig. 5; but as it is apt to accommodate itself to the form of any object to which it may cling, it is exceedingly variable in its shape. The flesh of this creature is unwholesome, but its strong, pepper-like flavour prevents it from being eaten by mistake for the edible oyster.

At page 83, fig. 4, is drawn another species, the PRICKLY SADDLE-SHELL (*Anomia aculeata*), as it appears when adhering to the stem of a sea-weed. In process of time it will accommodate itself to the rounded form of its support, and consequently have a longitudinal furrow upon the valve that would otherwise have been flat.

At Plate VI., fig. 14, is shown the inside of the COMMON OYSTER (*Ostræa edulis*); but as space is valuable, and both shell and animal are familiar to us, no description will be needed.

CHAPTER IX.

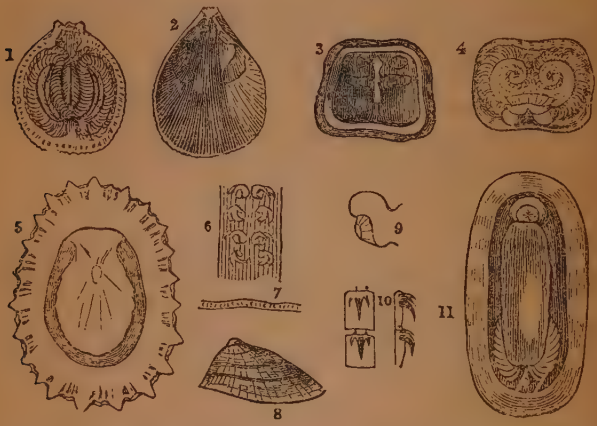
TWO SINGULAR GROUPS OF MOLLUSCS—THE BRACHIOPODA—DERIVATION AND REASON OF THEIR NAME—GENERAL HABITS OF THE ANIMAL—COMPARATIVE RARITY OF THE BRITISH SPECIES—THE LAMP-SHELLS—WHY SO CALLED—THE SNAKE-HEAD LAMP-SHELL—ITS SPIRAL ARMS—THE BEAKED LAMP-SHELL—THE PTEROPODA, OR WING-FOOTED MOLLUSCS—MODE OF PROGRESSION—WHERE FOUND ON OUR COASTS—THE THREE-SPINED GLASS-SHELL—ORIGIN OF ITS NAME—SUGGESTION AS TO ITS OCCURRENCE.

We now leave the ordinary bivalve shells, and come to two distinct divisions of Molluscs, the precise place of which is still exceedingly doubtful. As, however, this work follows the arrangement of Messrs. Forbes and Hanley, I have placed them in their present position. The creatures which form the first division are scientifically named Brachiopoda, or Arm-footed Molluscs, because their apparent organs of motion are two long, arm-like organs. These members, however, do not aid the animal in progression, inasmuch as it is always attached to some object by means of a pedicle, or footstalk, passing through a hole in the shell just by the hinge. A popular and appropriate name is Lamp-shells, because the closed valves of these creatures have a singular resemblance to an ancient lamp, the hole through which the wick of the lamp passes being very similar in form and position to that through which passes the footstalk of the mollusc.

In these creatures, the valves are locked together by very long, projecting teeth, which fit into each other with such exactness, that the valves cannot be separated without the use of much force; even the largest known species cannot be opened more than the eighth of an inch. Formerly, the Lamp-shells were considered so rare, that a good British specimen was

a treasure of which any museum might be proud; but in later days, since marine zoology has been so widely and deeply studied, these remarkable shells have become comparatively common.

Our best-known species is perhaps the SNAKE-HEAD LAMP-SHELL (*Terebratula caput-serpentis*), a figure of which is shown at Plate VII., fig. 1. The interior of the empty shell is shown in the accompanying illustration, fig. 2, and the animal within its shell at fig. 1.



In the latter figure the reader will not fail to notice the long, spiral, fringed arms, as they are coiled up within the shell.

The colour of the shell is greyish white; but in a specimen before me, the part next the hinge is yellowish brown, a fact which is due to the death of the enclosed animal, and the stains proceeding from its decomposed body. The average length of a fine specimen rather exceeds half an inch.

Another remarkable example of this division is the BEAKED LAMP-SHELL (*Crania norvagica*), so called because the spiral arms are supported by a sort of beak

in the middle of the lower valve. This species is found only on the northern coasts, and has been taken abundantly by the dredge off the shores of Scotland. A figure of the shell, as it appears of different ages, is is given at Plate VII., fig. 2; and the interior of the empty shell is shown at page 88, fig. 3, and the animal within it at fig. 4.

The second of these divisions embraces that singular group of Molluscs which are called Pteropoda, or Wing-footed, because they progress by means of flattened lobes which spring from the body, and which are flapped to and fro like the wings of a bird. They are all active beings, the peculiar flapping movements being rapidly repeated. Some possess shells, while others are destitute of those protections. Very few are found in the British seas, and it is likely that even those few speimens have been driven unwillingly into our waters by means of a current, or through an unexpected storm.

At Plate VII., fig. 3, is shown one of these curious animals, the Three-spined Glass-shell (*Hyalœa tridentata*), so called on account of the extreme fragility and transparency of its shell. So delicate, indeed, is the shell, that when placed in water, the colourless foot becomes totally invisible, just as is the case with a piece of very thin glass. There is, however, a slight tinge of ruddy brown near the lip of the shell. Messrs. Forbes and Hanley judiciously remark, that this creature is probably a more frequent visitor to our shores than is generally imagined, its extreme delicacy rendering it almost invisible.

CHAPTER X.

THE GASTEROPODA—THE NAME EXPLAINED—THE CHITONS, OR MAIL-SHELLS—STRUCTURE OF THE SHELLS—THE MARBLED MAIL-SHELL; ITS FORM AND COLOUR—SCULPTURE OF THE EXTERIOR—THE BRISTLY MAIL-SHELL, AND ITS CURIOUS APPENDAGES—THE RED MAIL-SHELL, THE ANIMAL, AND MAGNIFIED HEAD—THE GREY MAIL-SHELL; LOCALITY WHERE FOUND—THE GLOSSY MAIL-SHELL, AND ITS COLOUR—THE LIMPETS, AND THEIR KIN—THE COMMON LIMPET, ITS SHELL, ANIMAL, AND TONGUE-RIBBON—THE SMOOTH LIMPET, AND ITS VARIABLE FORM AND COLOUR—THREE REMARKABLE SPECIMENS—THE HORSE LIMPET, AND ITS USES—ITS BEAUTIFUL SHELL—THE TORTOISESHELL LIMPET; REASON FOR ITS NAME—THE ELEPHANT'S TUSK-SHELL; ITS CURIOUS FORM—THE GROOVED TUSK-SHELL—HOW TO DISTINGUISH THE SPECIES—THE HUNGARIAN CAP-SHELL, OR TURK'S CAP—REMARKABLE FORM OF THE SHELL—THE CUP-AND-SAUCER LIMPET—WHY SO CALLED—FORM OF THE YOUNG—THE TOOTH-RIBBON, AND ITS SPOON—THE NATURALIST'S DREDGE, AND ITS ADVANTAGES—THE KEYHOLE LIMPET; PECULIARITY OF ITS FORM—THE PERFORATED LIMPET—POSITION OF THE APERTURE—THE NOTCHED LIMPET—REASON FOR ITS NAME—ITS BEAUTIFUL FORM AND SCULPTURING—THE ROSY NOTCHED LIMPET—HOW DISTINGUISHED—THE ORMER, OR SEA-EAR—WHERE FOUND—ITS ELEGANT FORM AND BEAUTIFUL COLOURS—THE REGULAR SERIES OF APERTURES, FROM THE LIMPET TO THE ORMER.

THE vast group of GASTEROPODA, or Belly-footed Molluscs, demands a fresh chapter. The shells, when they exist, are formed only of one valve, the duty of closing the aperture falling to a kind of stopper, called the *operculum*.

The first of these are the Chitons, or MAIL-SHELLS, whose shells are composed of several pieces jointed together like a lobster's tail or a piece of ancient armour. Several species of Chitons are very plentiful on our coasts, and may be caught on the stones and rocks of the sea-shore, where they afford food to many a bird, beast, fish, and crustacean. The structure of this curious shell is thought to be explained by saying that the hindermost plate, which is firmly attached to

the animal, is the real shell, and that the others are supplementary plates. In the typical genus, of which the MARBLED MAIL-SHELL (*Chiton marmoreus*) is a good example, the shell is composed of eight pieces, and the animal has a kind of head, whereby it is at once distinguished from the headless bivalves. A figure of this species is given at Plate VII., fig. 5; and at page 88, fig. 9, is a side view of the head of another species, the RED MAIL-SHELL (*Chiton ruber*). This is the largest of our British species, as may be seen by reference to the illustration, which is rather smaller than an average-sized specimen now before me. The colour is rich brown, marbled with yellow and chesnut; but the chief beauty of the shell, namely, the elegant sculpture of the surface, cannot be seen without the aid of a magnifying-glass. The form of the animal as it appears in its shell is shown at page 88, fig. 11, at which is represented the under side of the Red Mail-shell.

On the same page, and at fig. 10, is shown a much-magnified representation of part of the "tooth-ribbon" of the BRISTLY MAIL-SHELL (*Chiton fascicularis*), exhibiting the peculiar teeth from two points of view. These tooth-ribbons are very beautiful organs in the Gasteropodous molluscs, and are valuable in distinguishing the species from each other. The shell itself is drawn at Plate VII., fig. 4, in order to show the curious bunches of bristle-like hairs that project from the margin. There are eighteen of these tufts, and their colour is very pale red. The general colour of the shell is greenish brown, mottled with chesnut or brick-red; but it is a very variable species in point of colour.

The commonest British species, the GREY MAIL-SHELL (*Chiton cinereus*), is shown at Plate VII., fig. 7, and is drawn of the natural size. Although an ashen grey is the principal colour, it is perhaps the most variable of its kind, being mottled or streaked with white, orange, chocolate, pink, lilac, and yellow. It

may be found by hundreds on any of our sea-shores, merely by searching among rocks, stones, piles, or other submerged objects.

A pretty but not so plentiful species is the Glossy Mail-shell (*Chiton lævis*), which is shown at Plate VII., fig. 6. The ridge along the back is rather sharply elevated, and the surface has a decided gloss. Red is the chief colour in this shell, and in a specimen now before me the ridge is rather light chesnut-red; the shelly plates at either end are dark brown, and the rest are variously tinted with brown, in which a dash of red is occasionally perceptible. It is seldom found in company with others of its kin, but inhabits similar localities.

We now come to the vast Limpet family, some of which are so familiar to every wanderer on the sea-shore. This family has been subdivided into others, and in my opinion needlessly so, as it might very properly comprise at least three other recently-formed families. However, as this work does not treat of systematic zoology, we will proceed at once to the typical species, the Common Limpet (*Patella vulgata*), which is found in such abundance on the rocks.

Viewed merely as a stationary object on a rock, it has no great beauty, especially as its shell is often encrusted with barnacles, polyzoa, zoophites, and sea-weeds; but when the animal moves about, it at once becomes interesting.

It is seen to best advantage when creeping up the glass side of an aquarium. This view of the animal is given at Plate VII., fig. 8, where are seen the well-defined head, the tentacles or feelers, and the mouth. In this mouth lies the tooth-ribbon, which, when uncoiled and placed under the microscope, affords a spectacle of wondrous beauty. A part of this ribbon, of the natural size, is shown at page 88, fig. 7, and a magnified portion at fig. 6. When extended, it is fully as long as the shell, and contains nearly two

thousand teeth. The inside of the shell is drawn at fig. 5, in order to show the scars of the powerful muscular apparatus that holds it so firmly to the rock by exhaustion of air under the foot-disc.

Its colour is grey-brown, occasionally varied by a little mottling; and its shape is usually of the well-known cup-like form. Distorted specimens are, however, very common, the deformity being caused by the locality in which the creature has lived.

Two other species are shown on Plate VII. One of them, the SMOOTH LIMPET (*Patella pellucida*), is remarkable for the extraordinary variation of the shell. Three specimens now before me are so unlike each other, that none but a practised conchologist would imagine that they could belong to the same species. One, which is the variety shown at page 88, fig. 8, is tolerably stout in structure and grey-brown in colour, with a few narrow, concentric lines of chocolate.

A second variety, which is shown rather inadequately at Plate VII., fig. 10, is pale horn-colour, very highly polished, and remarkable for a series of narrow ultramarine lines, that radiate from the peak to the edge. These lines are represented in the illustration by the white radiating lines, which give the shell a false appearance of being ribbed, whereas it is perfectly smooth. The substance of the shell is delicate, and as translucent as horn.

A third example is larger, narrower, flatter, quite as smooth, and far more translucent, so that ordinary type can be read through it. This particular specimen is very pale yellow, with a red patch at the peak, and a streak of the same hue along the top.

A very striking species is the HORSE LIMPET (*Patella athletica*), shown at Plate VII., fig. 9. Although variable in colour, it may easily be recognised by the bold, radiating ribs, which are covered with regular, tooth-like projections.

This species is common on most parts of our shores, but is only used occasionally as bait, and never even

for that purpose as long as the common species can be obtained.

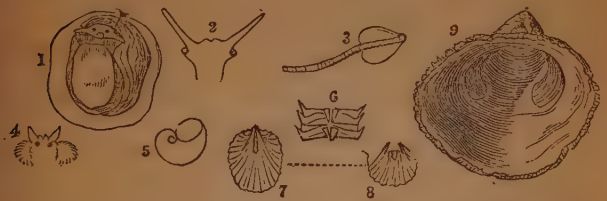
The little TORTOISESHELL LIMPET (*Acmæa testudinalis*) has been separated from the true Limpets on account of a different structure in the animal; as to the shell, it is almost exactly like that of any other Limpet. It may be easily recognised by the smooth surface, beautiful mottlings of white and chesnut with which the exterior is decorated, and the dark-brown mark in the interior. It is a small species, an average-sized specimen now before me measuring scarcely more than half an inch in length. It is found on our northern shores.

We now come to the Tusk-shells, which at first sight seem to be totally unlike the Limpets, as may be seen by reference to Plate VII., figs. 12 and 13. But the reader has only to imagine a Limpet-shell very much elongated at the expense of its width, and he will then have a good idea of the general form assumed by this group.

Fig. 12 represents the ELEPHANT'S TUSK-SHELL (*Dentalium entalis*), a common species on our northern shores, and easily recognised by the uniform white of the shell and the smooth surface. The other species, the GROOVED TUSK-SHELL (*Dentalium tarentinum*), is distinguishable by its pinky hue towards the narrow end, and the fine groovings which are drawn upon the large end. In these shells both ends are open.

A remarkable species, the HUNGARIAN CAP-SHELL (*Pileopsis Ungaricus*), is shown at Plate VII., fig. 14, where the animal is depicted in its shell, as it appears when protruded for walking. This shell can easily be recognised by the peculiar formation of the tip, which is bent in a partially spiral curve, very much like the conventional Cap of Liberty. Sometimes this species receives a less agreeable name, and is called the Fool's Cap.

It is variable both in shape and colour, but the peculiar tip is so conspicuous that it can always be recognised. A specimen now before me is about an inch and a quarter in length, and its colour is whitish in some parts and brown in others. The interior of the shell is shown in the accompanying illustration, fig. 9.

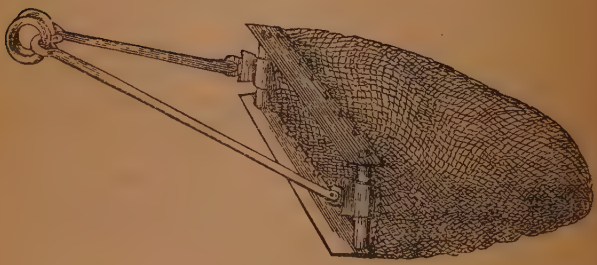


The variety of form to be found in shells is inexhaustible. At Plate VII., fig. 15, is shown the inside of a curious shell, that is popularly and appropriately called the CUP-AND-SAUCER LIMPET (*Calyptræa sinensis*). It derives its name from a curious plate in the interior, which in some examples is cup-shaped, and looks something like a very little cup in a very large saucer. Externally the shell resembles that of a common Limpet, but a glance at the interior is sufficient to decide the species to which it belongs. When the creature is young, the shell looks very like that of a tiny snail, as may be seen at page 95, fig. 5; and the peculiar fringed neck of the young, its eyes and thick tentacles, are shown at fig. 4. The tongue-ribbon of the adult, with its curious spoon-like appendage, is shown at fig. 3, and a magnified view of a few teeth at fig. 6: so we have in one creature the cup, the saucer, and the spoon.

This is a southern shell, common in the Channel Islands, and found on the southernmost shores of England. It must be taken by the dredge.

As this implement is so often mentioned, I have had a sketch made of a small and very convenient

form of dredge, called the Naturalist's Dredge, one figure showing it at work, and the other as it appears when folded. As may be seen by reference to the illustration, it can be packed in a very small space for convenience of transit; and as it has a double lip, it is sure to fall in the right position when it touches the bottom of the sea. The common dredge has only one lip, so that if it should turn over it does no work.



Small as is this instrument, it is wonderfully efficacious, and will penetrate into channels where the full-sized dredge could not pass.

We now come to a curious series of Limpets, which are notable for the aperture in the shell. The reader will remember that in the Tusk-shells there is an aperture at the peak, and the same is the case with the Keyhole Limpet (*Fissurella reticulata*), which is seen at Plate VII., fig. 18. Resembling the common

Limpet in general form, it may at once be distinguished by the hole at the top of the shell, through which issues the water that has passed through the system. This shell is to be found on many parts of our coast, but is most plentiful on the southern shores.

In another mollusc, the PERFORATED LIMPET (*Punctinella noachina*), which is shown at Plate VIII., fig. 3, the perforation is not at the apex, but just in front of it. The form and position of the aperture are shown at page 95, fig. 7, and its appearance when viewed from the interior is shown at fig. 8. The colour is slightly variable, but in my specimen it is dull grey-brown, except at the edge, which is white.

In another species, the NOTCHED LIMPET (*Emarginula reticulata*), which is drawn at Plate VII., fig. 16, the aperture is removed still further from the apex, and encroaches on the margin of the shell, so as to form a long notch instead of a perforation, as may be seen by the small outline immediately above the shell. It is a beautiful little shell, pure white, with radiating ribs, and the intervals between the ribs sculptured with regular squared holes, so that it looks as if two sets of ribs cut each other at right angles. Inside, round the notch, there is a slight thickening, which extends to the very apex of the shell. The small ROSE NOTCHED LIMPET (*Emarginula rosea*) is drawn in the same plate, fig. 17, and may be recognised by its tiny form, not a quarter of an inch in length, and the greatly curved apex, like that of the Fool's-cap shell. In some specimens the edges of the aperture are bright rose-colour, whence its name; but in the majority of instances the entire shell is white.

Taking the Channel Islands as British — about which, in a zoological point of view, there is some controversy—the ORMER, or SEA-EAR (*Haliotis tuberculata*), may rank as a British species. This lovely shell is drawn at Plate VIII., fig. 2. It is very flat, and, as may be seen by the illustration, has, not one

aperture, but a series of holes arranged in a row near the edge, and following the spiral curve of the shell. The outside of the shell is variously coloured with red, brown, or green, and is very rough to the touch. The inside is of a beautiful pearly consistence; and it is from this shell and its exotic kin that the workers in papier-maché obtain the plates of "pearl" with which their work is inlaid. Buttons and other articles are also made of the shell.

This species is plentiful on the shores of the Channel Islands, where it is much used for food; but the animal is very tough, and requires much beating and careful cooking to make it tender.

The reader will not fail to notice the regular and curious series which has just been described. In the common Limpet, we have a shell without any hole at all; in the Keyhole Limpet, a hole is seen at the apex; in the Perforated Limpet, the hole is shifted below the apex; in the Notched Limpet, it has reached the edge; and in the Ormer, a series of holes is arranged round the edge. There is another shell, called *Rimula*, found in the Philippines, which makes the series complete, and which has the hole half-way between the apex and the edge.

CHAPTER XI.

THE TOP-SHELLS—THEIR SHAPE AND USES—THE COMMON TOP—HOW TO DISTINGUISH IT—THE GREY TOP—LOCALITIES, AND DIFFICULTY OF OBTAINING A PERFECT SPECIMEN—THE PAINTED TOP—WHY SO CALLED—THE PHEASANT-SHELL—ITS BEAUTY AND VARIETY OF COLOUR—THE WHITE BELT-SHELL—ITS SCULPTURED SURFACE—THE VIOLET SNAIL—HOW IT REACHES OUR COUNTRY—REMARKABLE FORM OF THE ANIMAL—THE "FLOAT," AND EGG-SACS—COLOUR OF THE SHELL—THE RIVER NERITINA—ITS FORM AND COLOUR—THE COMMON WATER-SNAIL—MODE OF HATCHING ITS YOUNG—THE GREEN WATER-SNAIL—MODE OF DISTINGUISHING IT—THE COMMON BITHINIA, AND ITS LOCALITIES—THE VALVE-SHELL—THE COMMON PERIWINKLE—ITS TEETH, AND THEIR BEAUTIFUL STRUCTURE—THE PALE CHINK-SHELL—ORIGIN OF ITS NAME—THE BANDED CHINK-SHELL—THE DUN SENTINEL—REASON FOR ITS NAME—LOCALITIES WHERE IT IS FOUND—THE SPIRE-SHELLS—THEIR SMALL SIZE, AND PRETTY COLOURS—THE TURRET-SHELL—DIFFICULTY OF FINDING A PERFECT SPECIMEN—THE BLIND-SHELL, AND ITS RESEMBLANCE TO THE TUSK-SHELL—THE PELICAN'S FOOT—ITS CURIOUS SHAPE—THE WENTLETRAP, AND ITS BEAUTIFUL SHELL—PYRAMID-SHELLS—THE GLOSSY ACTIS—THE HUNGER-SHELL—THE RUDDY AND CONICAL PYRAMID-SHELLS—DIFFICULTY OF DISTINGUISHING THEM—THE NECKLACE NATICA—ORIGIN OF ITS NAME—THE SEMI-CONCEALED SHELL—THE SHINING NATICA—THE VELVET-SHELL—WHY SO CALLED.

We now come to the beautiful Tóp-shells, some of which are so plentiful upon our sea-coasts, especially those of a sandy character. Their shapes may be at once known by referring to figs. 1, 4, 5, in Plate VIII., and they are familiar to ladies, because some of the more delicate exotic species are largely used as ornaments for hair-nets, necklaces, trimmings of dresses, and similar purposes. I have even seen them used with great effect in an altar-cloth, the beautiful pearly shells contrasting forcibly with the crimson velvet on which they were arranged.

One of our best-known specimens is the Common

Top (*Trochus zizyphinus*), which is shown of its natural size at Plate VIII., fig. 5. This handsome shell has but little colour on the exterior, but there is generally some red in it. A fine specimen now before me is very pale yellow spotted spirally with pink. From this specimen the illustration was drawn, the dark spots representing these red patches. Although the Top-shells are found plentifully on our shores, it is not common to pick up a really perfect specimen; for the peak is generally rubbed away or even broken, so that the colour is removed and the white pearly shell is seen. The inside of the Top-shells is exactly like that of the Ormer.

Another familiar species, the Grey Top (*Trochus cinereus*), is shown at fig. 1 of the same Plate. This pretty shell is covered with zigzag grey-black markings on a yellowish ground, arranged as seen in the illustration. If the shell be turned up and viewed from below, a small perforation will be seen in the middle, through which an ordinary darning-needle can be passed, and which reaches to the very end of the shell. As it is not quite straight, a needle cannot pass to its extremity, but a bristle or stiff vegetable fibre will do so. In the accompanying illustration, fig. 1, is seen a magnified view of the head of this species, showing the eyes on their stalks, the tentacles, the flat head-lobes, and the fringed lappets of the neck. At fig. 2 is seen the spinal horny plate, or "operculum," with which the entrance of the shell is closed.

This hole is seen very greatly enlarged in another species, the Painted Top-shell (*Trochus magus*), which is shown at Plate VIII., fig 4. In this species the central hole is large enough to admit a crow-quill, and would allow a still larger object to pass, were it not partially closed at the anterior by the inner whorl of the shell, which passes partly over it. The outside of this shell is rather boldly ridged, and in some speci-

mens now before me it is decorated with reddish-brown patches, arranged spirally.

This is one of the shells used for ornament, the rough outer coat being removed, and the nacreous shell exposed to view. It is common on most of our coasts. The name of Painted Top is given to it on

account of the magnificent hues of the animal, which is gorgeously painted with dark blue, purple, white, scarlet, ultramarine blue, and primrose yellow.

It seems quite a pity that the lovely little PHEASANT-SHELL (*Phasianella pullus*) is not one of our largest instead of our smallest shells. Although not pearly like the Tops, it is very delicate, translucent, and coloured in the most brilliant manner. It is so

variable in this respect, that a description of all the varieties would take up almost the whole volume. Suffice it to say, that red is the predominant hue, mingled with yellow and brown, the ground-colour being white. No two specimens are precisely alike, and three specimens now before me are so differently coloured, that the uninitiated would imagine them to belong to different species. This tiny shell very seldom reaches a quarter of an inch in length.

At page 101, fig. 3, is a much-magnified representation of the head and neck of the Pheasant-shell, showing the long, fringed tentacles, the eyes at their bases, and the fringed neck-flap. At fig. 4 is shown the beautiful white operculum, which is flat at the edges, and much smoother and rounded in the middle.

At Plate VIII., fig. 9, is shown a curious little shell, which is chiefly found on our southern coasts. Its scientific name is *Adeorbis subcarinata*, and we may call it the WHITE BELT-SHELL. It is a very small species, its average diameter being the tenth of an inch, so that it often escapes observation owing to its minute dimensions. The colour is pure white, and the whole surface is covered with most beautiful sculpture, the general character of which is shown in the illustration.

Although plentiful in the warmer seas, the VIOLET SNAIL (*Janthina communis*), can only be reckoned by courtesy as a British shell. Owing to its singular formation, it is sometimes blown or drifted to our shores. In the Atlantic and Mediterranean it occurs by countless thousands, and may be swept up in buckets-full. A figure of the shell and its inhabitant, of the natural size, is given on Plate VIII., fig. 6. The singular organ extending from the shell is called the "float," and is made of a series of air-vessels. Attached to the float are a number of little bags, which contain the eggs; and the animal itself is seen lying in its shell, with mouth upwards. This is the

natural attitude, except that the shell and animal hang much lower than is represented, while the float remains horizontal on account of its buoyancy. The colour of the shell is pale blue, and a broad white belt usually occupies the upper part of the whorl. It is very fragile, and partially translucent.

At page 101, fig. 8, a front view of the empty shell is given. Several species of Violet Snail visit our coasts.

We now come to a shell which inhabits fresh water, but which must be mentioned here as forming a link in the chain. It is called the River Neritina (*Neritina fluviatilis*), and is found in many of our rivers, sometimes high up their course, and sometimes so near the mouth that the water is alternately salt and fresh twice in the twenty-four hours. It is a little shell, measuring on an average some quarter of an inch in length; and its colour is exceedingly variable, generally, however, spotted and mottled with yellowish white on a dark ground, as seen in the illustration.

On Plate VIII., fig. 10, may be seen the shell and animal of the Common Water-Snail (*Paludina vivipara*), a species which is extremely common in our fresh waters, being found abundantly in ponds and rivers, and in the latter preferring the sluggish parts, such as bays or the mouths of ditches. This creature hatches its eggs within its own shell; and at page 101, fig. 7, a sketch is given of the mouth of the shell and a few of the young within it. Fig. 6 represents the operculum.

There are two species of Water-Snail, so similar in general appearance that they are mostly confused with each other. A figure of the second species, the Green Water-Snail (*Paludina vivipara*), is given at Plate VIII., fig. 11. It may be easily distinguished by turning it up and looking at it from below, when the large hole that pierces through the centre of the shell, and is technically called the umbilicus, affords an unmistake-

able mark of the species. The Common Water-Snail has no umbilicus.

At Plate VIII., fig. 12, is a slightly enlarged figure of the Common Bithinia (*Bithinia tentaculata*), a pretty, delicate shell, which is plentiful in ditches and sluggish streams. The substance of the shell is exceedingly delicate and semi-transparent, and the animal is notable for its long and slender tentacles.

On the same plate, at fig. 13, is a shell which looks very much like a shortened Bithinia. This is the Common Valve-shell (*Valvata piscinalis*). The figure represents the elongated variety of this shell, with a small umbilicus; but there is a flattened variety, in which the umbilicus is exceedingly large. The colour is greyish brown, with a litle red towards the tip, and the surface is covered with small wrinkles. It is mostly found in semi-stagnant waters.

We now come to the Litorinidæ, a family which is better known by the popular name of Periwinkles. Most of them live in the sea, but some reside at the mouths of rivers; and some may be found at a considerable distance from the sea, so that the water in which they live is only brackish.

The Common Periwinkle (*Littorina littœa*), is drawn at Plate VIII., fig. 17, and is so familiar that it need not be particularly described. Some details of its structure are, however, given at page 101. Fig. 11 represents the tongue-ribbon of its natural size, and a magnified portion is shown at fig. 12. In order to show the curious form of the teeth themselves, a single row is drawn at fig. 13, on a greatly magnified scale.

Another member of the same family, though not of the same genus, is represented at Plate VIII., fig. 15. Its scientific name is *Lacuna pallidula*, and we will call it the Pale Chink-shell, a name which is a literal translation of its scientific title. It derives its name

from the "lacuna" or chink-like groove behind the mouth, and which is well shown in the figure. Its colour is pale yellow, and the inside of the chink is white. It is very common on sea-weeds on every shore. At page 101, fig. 9, is shown a magnified view of the eggs laid by this species; and at fig. 10 is shown the curious forms of animal and shell assumed by the young.

Another species of this genus is the BANDED CHINK-SHELL (*Lacuna vincta*). This is a larger species than the preceding, and is banded with four reddish-brown belts. It is found plentifully upon our coasts, and can be taken by hand without even wetting the feet.

At Plate VIII., fig. 14, is seen a little ordinary-looking shell. This is the DUN SENTINEL (*Assiminia Grayana*), a species that derives its name from the position of the eyes, which are set on moderately long tentacles, like those of the sentinel crab. A figure of the animal in its shell is given at page 101, fig. 5, in order to exhibit this structure. The shell is a very small one, rather under a quarter of an inch in length, and its colour is dun, with a decided gloss. It inhabits the mouths of tidal rivers, up which it passes for a considerable distance, as may be seen from the fact that it may be taken as high up the Thames as Woolwich, or even Greenwich.

We now come to a very large family of very little shells, all of which are graceful in form, and many are also pretty in colour. The form is always that of a much elongated spiral, and we will therefore call them Spire-shells. Our first example is the NOTCHED SPIRE-SHELL (*Rissoa crenulata*), a shell that is found in vast quantities on some of our shores. It is a beautiful little shell, cream-white in colour, and having the surface covered with spiral ridges, and the mouth regularly notched, the notches being caused by the ends of the spiral ridges. This tiny shell, which is

shown at Plate VIII., fig. 21, seldom exceeds the fifth of an inch in length. The figure is nearly twice the natural size.

At fig. 23 of the same Plate is drawn an enlarged figure of another species, the THICK-LIPPED SPIRE-SHELL (*Rissoa labiosa*). It is a pretty little shell, and is rather variable, sometimes being quite smooth, and sometimes covered with well-marked folds. A specimen of the smooth variety, now before me, looks exactly as if it had been made of very thin horn, and the shell is so delicate that it seems scarcely able to endure the least touch. This species is found on the shores, and can be taken in a living state upon the sea-grass, or zostera, which sprang so suddenly into fame a few years ago.

At the same Plate, fig. 22, is represented the LAVER SPIRE-SHELL (*Rissoa ulvæ*), so called because it is found upon the laver, or ulva, and often follows this well-known sea-weed for a considerable distance up large rivers. Salt marshes abound in this shell, which forms one of the many causes why gulls and other sea-birds are so fond of such spots. This is a darker species than either of the others, the colour being blackish brown. Its length is barely a quarter of an inch.

At Plate VIII., fig. 19, is shown the common TURRET-SHELL (*Turritella communis*), one of the best known of our shells, though it happens to be the only British representative of its genus. Its regularly twisted and gradually tapering form are quite enough to enable the captor to identify it. Although it is so plentiful, a perfect specimen is seldom picked up, because the slender peak and thin edge of the lip are so fragile, that one or both is mostly damaged.

At fig. 20 of the same Plate is drawn a magnified representation of a tiny shell not more than the eighth of an inch in length, and of a whitish colour. It much resembles the Tooth-shells, but may be distinguished

from them by the fact that the upper end of the shell is not perforated. It is therefore called the BLIND-SHELL (*Cæcum trachea*).

On the same Plate, at fig. 18, is drawn a curious species, called the PELICAN'S FOOT (*Aporrhais pespelecani*), because the peculiar formation of the mouth is fancifully thought to resemble the foot of a pelican. The shell is a tolerably large one, being about two inches in length, and its substance is very solid. Its colour is whitish brown. An under view of the shell is given at page 101, fig. 15; and some of the teeth are drawn at fig. 14, on a greatly magnified scale.

We now come to a shell that might possibly be mistaken for the Turret-shells, but which can easily be distinguished by the numerous tubercles with which the surface is covered. Some specimens are more or less ribbed. This is the common HORN-SHELL (*Cerithium reticulatum*), an elegant and rather variable shell, which is common upon our coasts. This species is drawn on a magnified scale at Plate IX., fig. 1.

A singularly beautiful shell, the common WENTLE-TRAP (*Scalaria communis*), drawn at Plate IX., fig. 3, is easily recognised by the bold ribs that issue from the shell, and follow its spiral in a series of most graceful curves. The head of another species is drawn at fig. 2, in order to show the long tentacles in the bases of which the eyes are sunk.

There is a group of molluscs called the Pyramid-shells, which are distinguished from the Spire-shells on account of the structure of the animal rather than of the shell. One of these creatures is the GLOSSY ACLIS (*Aclis supra-nitida*), which is drawn on Plate IX., fig. 4. It is a very little shell, not much more than a quarter of an inch in length, and is of a polished white hue.

Another species is the *Eulima polita*, a name which we may literally translate as the Polished Hunger-shell. The colour of this shell is white, and its texture is so transparent that the form of the animal can be partly seen through it, as is represented at Plate IX., fig. 6, where the eyes and part of the tentacles are visible through the shell.

Yet another species is seen at fig. 5 of the same Plate. This is the Ruddy Pyramid-shell (*Chemnitzia rufescens*), which may be recognised by its ribbed

exterior and its mouth without a tooth. The colour is pale-red, banded spirally with a darker hue.

Our last example of these curious little shells is the Conical Pyramid-shell (*Odostomea conoidea*). To distinguish these shells is a very difficult task, and one that requires much care and attention. Suffice it to say, that this shell may be distinguished from the others by the strong fold or tooth in the inner lip. The figure is nearly twice the real size of the shell. See Plate IX, fig. 7.

Viewed by itself alone, the shell of the Necklace

NATICA (*Natica monilifera*) presents nothing of particular interest, it being merely a large pale yellow shell, very like that of a snail. See Plate IX., fig. 8. But it becomes interesting when we see how curiously it is overlapped by various portions of the animal, as is seen at fig. 9 of the same Plate. It receives the name of Necklace Natica from the curious ribbon-like form in which its eggs are laid, somewhat resembling a broad necklace of pearls. This is shown in the illustration at page 108, fig. 1. Another species, the SHINING NATICA (*Natica alderi*), is shown at fig. 2. About six species of Natica are known.

The peculiar envelopment is completely carried out in the VELVET-SHELL (*Velutina lævigata*), where the shell is completely concealed by the animal. It derives its name from the velvet-like epidermis with which it is covered. The shell is shown at Plate IX., fig. 10; the head is drawn at page 108, fig. 4, and the teeth at fig. 3.

CHAPTER XII.

THE WHELKS, AND THEIR KIN—THE STING-WINKLE—REASON FOR ITS NAME—THE DWARF WHELK—ITS CHANGE OF COLOUR—THE DOG PERIWINKLE, AND ITS PURPLE DYE—THE DOG-WHELK—ITS EGGS, AND DEVELOPMENT OF THE YOUNG—THE COMMON WHELK—ITS EGG-SACS AND YOUNG—THE ICELAND SPINDLE—ITS HEAD AND TEETH—THE LATTICED NURSE-SHELL, AND ITS BEAUTIFUL SURFACE—THE ROSY CONELET, AND OTHERS OF THE SAME GENUS—THE EUROPEAN COWRY—ITS APPEARANCE WHEN LIVING—THE EGG-SHELLS—WHY SO CALLED—THE MARGIN-SHELL—THE BUBBLE-SHELLS, AND THEIR STRUCTURE—THE CANOE-SHELL—WHY SO CALLED—THE LOBE-SHELL—THE SEA HARE—FALSE IDEAS OF THE ANIMAL—THE NUDIBRANCHS—THEIR APPEARANCE IN AND OUT OF THE WATER—A FEW LAND AND FRESH-WATER SHELLS—THE SEPIA, OR COMMON CUTTLE-FISH—ITS APPROACH TO THE VERTEBRATES—ITS SO-CALLED "BONE," AND ITS STRUCTURE—THE EGGS AND YOUNG—THE SQUID—ITS BONE, AND END OF AN ARM—THE CALAMARY AND ITS BONE.

We now come to the great family of the Whelks, our first example of which is the Sting Winkle (*Murex erinaceus*), which is so called by fishermen because it bores holes into other molluscs and devours them, in accordance with the predacious character of the entire group. See Plate IX., fig. 16. It is very plentiful at a moderate depth, and may easily be recognised by reference to the illustration. The colour is whitish, with a little yellow or chesnut.

At the same Plate, and at fig. 14, is the Dwarf Whelk (*Lachesis minima*); a curious little shell, which changes colour from dark reddish-brown when alive to chesnut after death. It is found on the southern coasts, rather below low-water mark.

The well-known Dog Periwinkle (*Purpura lapillus*), which is shown at the same Plate, fig. 11, is celebrated as producing the much-prized purple dye of the ancients. The dye is found in a sac behind the animal's head, and is yellow at first, but becomes blood-red by

exposure to the sunshine. The colour is variable, and is often very pretty, consisting of alternate spiral bands of white and orange or brown or chesnut. Some specimens are nearly smooth, while others are spirally ridged. It is extremely plentiful on all our coasts.

At fig. 12 of the same Plate is the common Dog Whelk (*Nassa reticulata*), which is so plentiful on our shores. The exterior of the shell is covered with bold tuberculated ribs; and the colour is brown on the outside, and pinkish white within the shell. It may be picked up alive at low-water, feeding on the sea-weeds. The front view of the shell is well drawn at page 108, fig. 7, and its remarkable egg-sacs are shown at fig. 8; and figs. 9, 10, and 11 show the development of the young, sketched by Mr. Sowerby from the living specimens.

The common Whelk (*Buccinum undatum*) is drawn at Plate IX., fig. 15; and the animal and shell are so familiar as to need no description. Some interesting details of its structure are, however, given in the accompanying illustration.

At fig. 1 is a strangely distorted specimen, in Mr. Sowerby's collection. At fig. 2 is a double operculum, a deformity which is not very uncommon. The ordinary shape is seen at fig. 5. At fig. 3 is shown a

magnified portion of the tooth-ribbon, and at fig. 4 is shown a single row of teeth very much magnified. Fig. 8 represents a group of the egg-sacs, as they are so often found on the shore; fig. 6 represents one of the sacs as it appears after the little inmate has broken its way through; and fig. 7 shows the young shell as it appears when it first leaves the egg-sac.

The Spindle-shells are well represented on our shores. Our present example is the pretty ICELAND SPINDLE (*Fusus Islandicus*), which is represented on Plate IX., fig. 13. This pretty shell is pure white, but it is covered with a yellowish epidermis, which easily rubs off when dry. The whole shell is traversed by delicate ridges, which follow the spiral form of the whorls. The head of this species is shown at page 108, fig. 5, and its teeth, much magnified, at fig. 6.

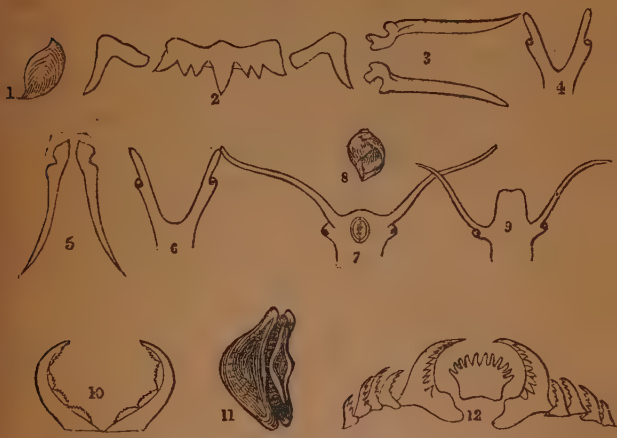
The largest of the British species is that which is popularly known as the Buckie or Roaring-shell, and it reaches six inches in length. It is sometimes called the Red Whelk, and its scientific name is *Fusus antiquus*.

Our last example of this group is that which is shown at Plate X., fig. 1, and which is called *Trophon clathratus*. A literal translation of this name is the LATTICED NURSE-SHELL. It rather changes its hue by age, being reddish-brown when young, and grey-white when adult. It is represented of the natural size, and may be recognised by the longitudinal ribs. The operculum of this species is shown on page 113, fig. 1, and one row of its teeth at fig. 2.

Most of the Cone-shells inhabit tropical countries, but some are inhabitants of our shores.

Our first example is the ROSY CONELET (*Mangelia turricula*), one of a very large genus, including more than twenty acknowledged British species: Plate X., fig. 2. The colour of this shell is white, with a rosy tinge in most specimens; and there is a bold, angular

channel between the whorls. It is common at moderate, and even at great, depths. The head of this species is shown in the accompanying illustration, at fig. 4, and the teeth at fig. 3.



Another species, the SEVEN-RIBBED CONELET (*Mangelia septangularis*), is shown at Plate X., fig. 3, and may be known by the peculiarity from which it takes its name, the whorls being marked with seven bold longitudinal ribs. The substance of the shell is very thick, and the colour is pinkish-yellow, sometimes deepening to a livid hue.

A deeply-coloured but variable species, the RED CONELET (*Mangelia rufa*), is either chocolate, orange, purple, or chesnut; but, whatever be the hue, red always predominates. In form it is as variable as in colour; but the ordinary shape is that which is represented at Plate X., fig. 4. The head and teeth of this species are shown above, at figs. 6 and 5.

We now come to the Cowries, a very few of which beautiful shells inhabit our coasts. The animals are

remarkable for their habit of concealing the greater part or the whole of the shell with the soft parts of the body. Three views of the European Cowry (*Cyprœa Europœa*) are given at Plate X., figs. 5, 6, 7, the last drawing being made in order to show how the shell is concealed, leaving only a small portion visible along the back. It is very plentiful on all our shores, and very variable. Its head is drawn at page 113, fig. 7, and the young shell at fig. 8, showing how great is the change of form by age.

The well-known Egg-shells belong to this group, and derive their name from their resemblance to "poached" eggs. The Gaping Egg-shell (*Ovula patula*) is shown at Plate X., figs. 8 and 10, and may be known by the peculiar shape, and the white or slightly pinkish hue. It cannot be mistaken for any other species.

An allied shell, the Margin-shell (*Marginella lævis*), is shown at Plate X., fig. 9, as it appears when crawling; and figs. 11 and 12 exhibit two different views of the empty shell. It may be known by the shape, the ivory-like surface, and the broad, thick outer lip. It is found scattered on all our coasts. Its head is drawn at page 113, fig. 9, and its teeth at fig. 10.

The Bullidæ, or Bubble-shells, find a few representatives on the English coasts. At Plate X., fig. 31, is shown the Cylindrical Bubble-shell (*Cylichna cylindrica*). This species is plentiful around our coasts, and can easily be distinguished by its blunt ends and white colour. Fig. 14 shows the same shell inhabited by the animal, as it appears in the act of crawling. The curiously-formed teeth of this species are shown at page 113, fig. 12. Several species of this genus are found in England. One of them, the Blunt Bubble-shell (*Cylichna obtusa*), is shown at fig. 15, Plate X.

An allied, but apparently distinct form of shell, is shown at Plate XI., fig. 1. This is the Actæon-shell (*Tornatella fasciata*). It may easily be recognised,

not only by its form, but by the pretty white bands upon the reddish-lilac shell. The animal pours out a purplish fluid when disturbed. It is found on all our coasts.

A curious species, the SOFT BUBBLE-SHELL (*Akera bullata*), is shown at the same Plate, fig. 16. This shell may be distinguished by its semi-transparent, horny look, and the elastic, almost flexible, character of its structure. It is plentiful in some places, but scarcely ever to be found in others. It is remarkable for possessing certain triangular horny tentacles in the gizzard, as may be seen at page 113, fig. 11.

We have only two examples of the typical genus in England, one of which, the THIN BUBBLE-SHELL (*Bulla hydatis*), is shown of its natural size at Plate X., fig. 18. The shell itself is white, but it is covered with a yellowish epidermis, which hides the true colour until it is removed. The shell is extremely thin and paper-like in structure. It is a southern species, and is obtained by tearing up the great sea-weeds from their attachments.

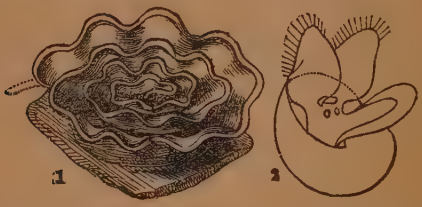
At Plate X., fig. 17, is a drawing of the CANOE-SHELL (*Scaphander lignarius*), so called because, in the first place, it is of a somewhat boat-like shape, and in the second, the colour of its surface looks very like the grain of wood. The usual colour is reddish-dun, and it is covered with a shining epidermis. It is mostly taken with the dredge, on sandy ground.

A still more curious species is shown at fig. 19 of the same plate. This is the common LOBE-SHELL (*Philine aperta*), which might easily be found in the living state and yet not recognised. This creature wholly envelopes the shell within the soft part of its body, as is seen at fig. 20, so that it presents a very remarkable appearance. The shell is thin, delicate, and of a pure white.

Another of these shell-concealing molluscs is shown at Plate XI., fig. 2. This is the SEA HARE (*Aplysia*

hybrida), an odd-looking creature, which is perfectly harmless, but of which the sailors and fishermen are terribly afraid, accrediting it with all sorts of poisonous qualities. The shell, or rather the shield of this species, is small, flattish, and horny, and very much resembles that of the common slug. A drawing of it is given at fig. 3. The body is remarkably extensible. Like the Actæon, it pours out a purplish fluid when alarmed. It is common throughout our coasts.

We now come to that curious group of molluscs called Nudibranchs, because their breathing apparatus is external. They have no shell, and therefore will be but casually mentioned. When removed from the water, they are by no means sightly, looking like mere lumps of jelly; but when they are placed in their proper element, they are among the most lovely inhabitants of ocean, nearly transparent, and glorious with every imaginable hue.



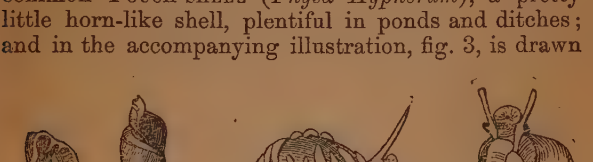
Two forms of these remarkable creatures are given in Plate XI., at figs. 5 and 6. Although when adult they are shell-less, the young possess a very delicate shell during the first part of their existence, as may be seen in the accompanying illustration, fig. 2. Fig. 1 represents one of the curious egg-ribbons produced by the Doris. The British seas contain a vast number of species, which exhibit the most weird-like shapes it is possible to conceive.

In order not to break the series, a few Land Mol-

luscs occupy the rest of the Plate. At fig. 7 is shown one of the slugs called Testacella, to show the shield, or shell, which is in this creature placed on the end of the foot; and in the Common Grey Slug, fig. 9, the shell is seen towards the head and under the mantle.

To describe the rest of these land shells would occupy too much space; but their names can be found by reference to the List of Illustrations, and their species easily identified by the figures.

A few of the fresh-water species must, however, have a brief notice. On Plate XII., fig. 13, is seen the common POUCH-SHELL (*Physa Hypnorum*), a pretty little horn-like shell, plentiful in ponds and ditches; and in the accompanying illustration, fig. 3, is drawn



a living specimen of another species, *Physa fontinalis*, in order to show the curiously-fringed mantle clasped over the shell.

Figs. 14 to 18, and fig. 24, represent different species of the Flat Water-snails; and figs. 20 and 21 show the pretty little Fresh-water Limpet, with its semi-transparent shell. The COMMON WATER-SNAIL (*Limnæus stagnalis*) is shown at fig. 22; and two other species of the same genus are seen at figs. 23 and 25.

At the bottom of the Plate is seen a rather large figure, which represents one of our cuttle-fishes, the COMMON SEPIA (*Sepia officinalis*). In these curious molluscs there is an evident approach to the vertebrates, the so-called "bone" which strengthens their

bodies being an incipient back-bone. The bone of this species is familiar to all who have walked by the sea-shore, and even those who have not enjoyed that privilege may have seen it in the druggists' shops, where it is sold for the purpose of a dentifrice. The chief mass of the "bone" is, in fact, the purest chalk, arranged in a most beautiful manner, looking like countless rows of snow-white pillars. Under the microscope and with polarised light, it is a truly wonderful object.

The singular projections from the head are popularly called arms, because with them the cuttle-fish seizes and secures its prey. This it does, not by clasping its arms round the unfortunate creature, but by applying to it some of the circular discs with which the arms are studded. These discs constitute, in fact, a sucking apparatus of wonderful efficacy, each of the discs being a miniature air-pump which can be worked independently of any other. In the present species there are many hundreds of these suckers, so that their combined force is very great. How powerful is their adhesion, may be realised by comparing with them the well-known pneumatic pegs, which are so largely used by photographers in taking up glass plates which ought not to be touched by the hand, and by shopkeepers in hanging goods in their windows, the peg being fixed to the pane by the pressure of the air. Now, these ingenious pegs are nothing more than artificial models of the Cuttle-fish's suckers, and are copied as exactly as art can imitate nature.

In the midst of the arms is the mouth, with its formidable pair of jaws, looking like a parrot's beak, so that the creature is as formidable a creature as a mollusc can well be imagined to be. Some of the larger species, indeed, which inhabit tropical seas, grow to so large a size that they are even dreaded by man.

It is rather curious that, although the "bone" of this species is often found, the animal is rarely seen.

A drawing of this "bone" is seen in the accom-

panying illustration, fig. 3. In the same engraving, fig. 1, is a representation of two rows of teeth of the tongue-ribbon; and at fig. 2 are shown the formidable pair of horny jaws which arm the mouth, and whose potency is shown by their stout, hooked forms and the strong attachments for the muscles. The grape-like eggs of this species are very plentiful upon the shore

at the right time of year, and can be easily hatched. I have often watched the little Sepia break away from the soft egg-shell, and enter the world as much at its ease as if it were quite an old inhabitant, and knew all about the life upon which it had just entered. At fig. 5 is seen the horny bone of the common SQUID (*Sepiola atlantica*), which is so plentiful on our shores; and fig. 4 represents very accurately the termination of one of its arms, with the sudden change in size of the sucking discs.

This pretty little creature is barely two inches in

total length, and is a most active animal, darting through the water with exceeding velocity, and aiding its progress by the large fin-like projections on its sides. There are some tropical species which are popularly called Flying Squids, because when they are alarmed they dart out of the water, and pass over a considerable distance before they fall into the sea. Thousands are sometimes seen to project themselves simultaneously into the air, to avoid the attack of the coryphene and other predacious fishes; and the active little molluscs have been known to shoot fairly over the hull of a ship.

The "bone" of the common CALAMARY (*Loligo vulgaris*) is shown at fig. 6. Several of these bones, or "pens," as they are sometimes called, are frequently found in the body of a single specimen.

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12. Nassa reticulata. Sea-weeds, zostera, &c.
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4. Mangelia rufa. Everywhere.
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8, 10. Ovula patula. Sand, sea-weeds.
9, 11, 12. Marginella (or Erato) lævis. Sand and sea-weeds.
13, 14. Cylichna cylindrica. Tentacles united in front, the eyes showing through the shell. Sand and sea-weeds.
15. Cylichna obtusa. Mouths of rivers, sand and mud.
16. Akera bullata. Sea-weeds.
17. Scaphander lignaria. Sand.
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22. Bulimus acutus. Sea-cliffs.
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24. Helix virgata. Chalk and limestone soils.

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5. Clausilia laminata. Trunks of trees.
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7. Zua lubrica. Under dead leaves.
8. Azeca tridens. Moss in woods.
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12. Succinea gracilis. Marshes, sides of lakes and rivers.
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14. Planorbis vortex. Slow streams, &c.
15. Physa fontinalis. Ponds and ditches.
16. Planorbis vortex.
17, 18. Planorbis corneus. Ponds, &c.
19. Planorbis marginatus. Rivers, &c.
20, 21. Ancylus fluviatilis, having a limpet-like shell, although of the same nature as Limnæus. Rivers.

22. Limnæus stagnalis. Still, fresh waters.
23. Limnæus auricularis. Still, fresh waters.
24. Planorbis lacustris, having internal septiform divisions. Still, fresh waters.
25. Limnæus pereger. Brackish waters.
26. Carychium minimum. Enlarged. Wet moss.
27. Conovulus denticulatus. Brackish water.
28. Cyclostoma elegans. Roots of brushwood.
29. Sepia officinalis. Any seashore.

Page 4.

1. Section of an ascidian. (*Ascidium monachus.*)
2. Cynthia aggregata. Free, tadpole form.
3. Ditto. Adult and fixed. The bead-like projections at the bottom are supposed to be germs, or buds.

Page 9.

1. Pholas dactylus. Inside of shell, showing the "scars" or marks where the muscles were attached; also the looped mark of the attachment of the mantle. Inside the hinge, the "process" is seen projecting into the shell.
2. Ditto. The accessory valves.
3. Ditto. The chambered bridge on which the accessory valves are placed.
4. Ditto. Siphon-tubes.
4*. Ditto. Siphon-tubes, showing the extremity.
5. Pholas candida, showing the single accessory valve in its place on the back of the shell.

Page 14.

1. Teredo bipennata. One valve of the shell, and the pair of long horny pallets.
2. Teredo palmulata. One valve, and short horny pallets.
3. Teredo malleolus. One valve, and short shelly pallets.
4. Teredo norvagica. Inside of shell, showing the curved process of the hinge, and the valves of shell united.
5. Ditto. The pallets.
6. Ditto. End of siphon-tubes, showing the double opening. A part of the shelly tube is broken away to show the chambered structure of the interior.
7. Curious example of a tube being continued into a hollow.
8. Xylophaga dorsalis, or Wood-borer. The valves closed. Pair of accessory valves over the hinge.
9. Ditto. A specimen buried in wood, to show how it burrows across the grain.

Page 18.

1. Gastrochæna modiolina. Shell in tube, the latter attached to a piece of broken shell and small stones. From a specimen in Mr. Sowerby's collection.
2. Ditto. A well-made tube, detached, showing its formation of sand, pebbles, &c., agglutinated; showing also its double but not quite separated orifice.
3. Ditto. Shell out of tube, to show hinge.

Page 25.

At the top of engraving, an outline of a valve of Lutraria.
1, 2. Mya arenaria. Showing the hinge, the elastic substance, and the spoon-shaped process which presses against it.
3. Corbula nucleus. Inside of shell, showing curved tooth of deep valve.
4. Neæra cuspidata. End of siphon-tubes, to show the tentacles with which they are surrounded.
5. Thracia phaseolina. The shell.
6. Ditto. Outside of hinge, showing the "ossicle" in its place on the hinge. A magnified representation is given between figs. 5 and 6.
7. Pandora rostrata. Inside of deep valve and hinge of flat valve, showing the tooth and small narrow elastic cartilage.
8. Solen marginatus. End of shell, showing the characteristic groove.
9. Cochlodesma prætenue. Both valves of shell, showing the spoon-shaped process into which the elastic cartilage is received.
10. Solen siliqua. Showing teeth and muscular impressions.
11. Tellina incarnata. Inside of valve.
12. Mactra stultorum. The hinge.
13. Donax anatinus. The hinge.
14. Scrobicularia piperita. The hinge.
15. Psammobia ferroensis. The hinge, and two diverging teeth.

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1. Tapes decussata. Oddly disfigured.
2. Tapes pullastra. Boring or hole-dwelling variety.
3. Tapes virgineana. Inside, showing teeth, muscle-marks, &c.
4. Lucinopsis. Inside.
5. Cytheræa. Inside.
6. Artemis exoleta. Inside.
7. Cyprina Islandica. Inside.
8. Venus verrucosa. Inside.
9. Astarte sulcata. Inside.
10. Lucina borealis.
11. Circe minima. Inside, and magnified hinge.

Page 59.

1. Kellia nitida. Shell and hinge.
2. Lepton squamosum. Inside.
3. Cardium edule. Inside of shell and spinose-tubes.
4. Kellia suborbicularis. Inside.
5. Turtonia minuta.
6. Isocardia cor. Inside.
7. Montacuta bidentata. Hinge.
8. Isocardia. Spiral umbones.
9. Pisidium amnicum. Inside.
10. Cyclas rivalis.

Page 69.

1. Dreissena polymorpha. Inside, showing septum near the apex, and a kind of pearly growth.
2. Unio pictorum. Inside.
3. Crenella discors. Inside.
4. Anodon. Inside.
5. Modiola tulipa.
6. Mytilus edulis. Inside.
7. Modiola phaseolina. Showing fringe not serrated.
8. Modiola barbata. Fringe serrated.

Page 78.

1. Arca tetragona. Hinge area.
2. Arca lactea. Inside.
3. Leda caudata.
4. Ditto. Base of foot.
5. Nucula nucleus. Inside, and profile of teeth.
6. Pecten varius. Inside.
7. Lima hians. Inside.
8. Pectunculus glycimeris. Do.

Page 83.

1. Anomia ephippium. In shell.
2. Ditto. Attached valve, showing button coming through the opening of shell.
3. Ditto. The button itself.
4. Anomia aculeatum. On stem of Gorgonia.
5. Anomia ephippium. Young.
6. Pinna pectinata.

Page 88.

1. Terebratula caput-serpentis. Animal in lower valve.
2. Ditto. Inside of upper valve.
3. Crania norvagica. Inside of valve.
4. Ditto. Animal in valve.
5. Patella vulgata. Inside of shell, showing muscular scars.
6, 7. Lingual ribbon of same, and teeth enlarged.
8. Patella pellucida. Thick variety, called patella cornea.
9. Chiton ruber. Side view of head.
10. Lingual teeth of Chiton.
11. Chiton ruber.

Page 95.

1. Calyptræa sinensis.
2. Ditto. Head enlarged.
3. Ditto. Lingual teeth, and spoon-shaped termination of lingual ribbon.
4. Ditto. Head of the fry.
5. Ditto. Shell of fry.
6. The teeth much magnified.
7, 8. Punctinella noachina. Showing slit near the apex, and interior vaulted lamina over the slit.
9. Pileopsis ungaricus. To show shell with muscular impression.

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The Naturalist's Dredge. Folded, and at work.

Page 101.

1. Trochus cinereus. Head.
2. Ditto. Horny operculum magnified.
3. Phasianella pullus.
4. Ditto. Shelly operculum much magnified.
5. Assiminia Grayana. In shell.
6. Paludina vivipara. Operculum.
7. Ditto. Shells in mouth of shell, as developed before quitting the body of parent.
8. Janthina communis. Showing notch in mouth and sinus in lines of growth.
9. Lacuna pallidula. Spawn.
10. Ditto. Early development.
11. Littorina littorea. Lingual ribbon and tongue.
12. Ditto. Ribbon enlarged.
13. Ditto. Teeth much enlarged.
14. Aporrhais. Teeth.
15. Ditto. Shell, showing form of mouth.

Page 108.

1. Natica monilifera. Egg-coil.
2. Natica alderi.
3. Velutina. Teeth.
4. Ditto. Head.
5. Fusus Islandicus. Head.
6. Ditto. Teeth.
7. Nassa reticulata. Front view of shell.
8. Ditto. Eggs and egg-bags.
9, 10, 11. Ditto. Stages of development of animal and shell, as observed by Mr. Sowerby in the tank of Mr. Lloyd.

Page 111.

1. Fusus antiquus. Curious distortion of, from Mr. Sowerby's collection.
   Buccinum undatum. A curious double operculum; a deformity which has lately occurred in a considerable number of specimens, the operculum being formed of two, or even three, more or less separated portions, with distinct nuclei.
3. Ditto. Tooth-ribbon much magnified.
4. Ditto. Teeth enlarged.
5. Ditto. Operculum.
6. Ditto. Broken egg-capsules.
7. Ditto. Shell of fry.
8. Ditto. Group of egg-capsules.

Page 113.

1. Trophon. Operculum.
2. Ditto. Teeth much magnified.
3. Mangelia turricula. Teeth.
4. Ditto. Head.
5. Mangelia rufa. Teeth.
6. Ditto. Head.
7. Cypræa Europæa. Head.
8. Ditto. Young shell.
9. Marginella lævis. Head.
10. Ditto. Teeth.
11. Akera bullata. Stomach-bones.
12. Cypræa obtusa. Teeth.

Page 116.

1. Doris rufa. Egg-ribbon.
2. Ditto. Young.

Page 117.

1. Pupa secale. Mouth of shell.
2. Clausilia laminata. Shell purposely broken near mouth, to show the spiral structure.
3. Physa fontinalis. Showing digitated mantle over shell.
4. Cyclostoma elegans. Operculum.
5. Ditto. In shell, showing the divided foot and method of walking by putting forward and expanding the lobes alternately. The sucker-like mouth is also used to aid its progress.

Page 119.

1. Sepia officinalis. Teeth and tongue.
2. Ditto. Horny mandibles.
3. Ditto. "Bone," *i.e.*, incipient chalky backbone.
4. Sepiola atlantica. End of arm.
5. Ditto. Bone.
6. Loligo media. Bone.

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PLATE II.

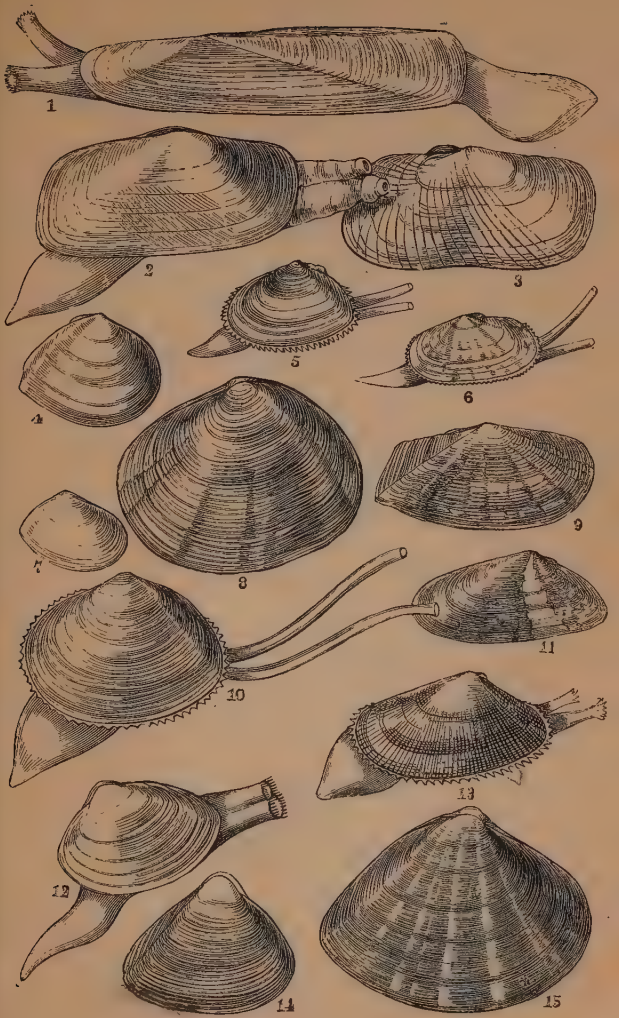

PLATE III.

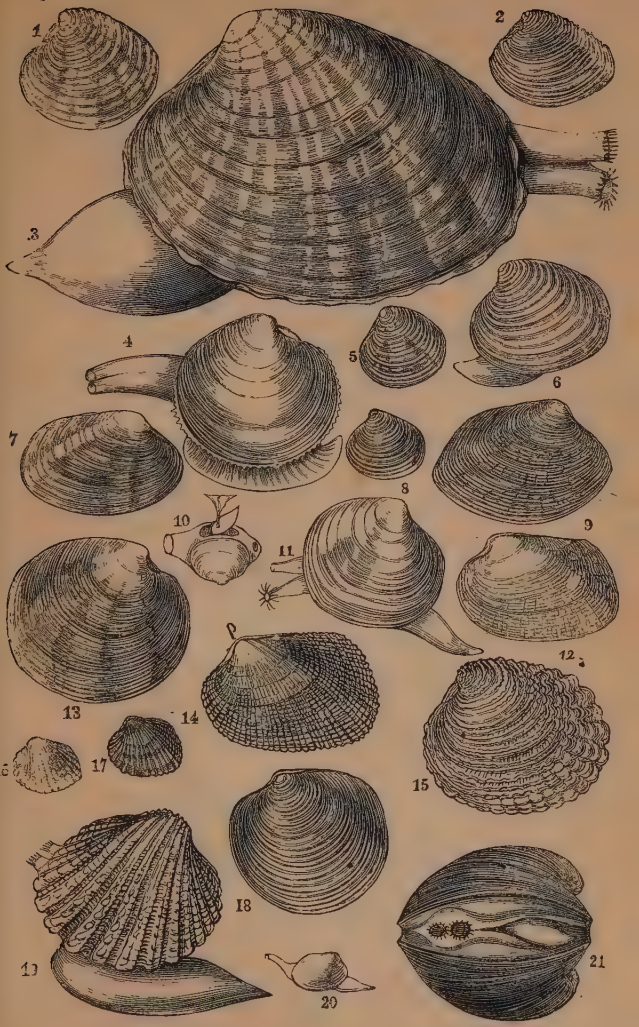

PLATE IV.

PLATE V.

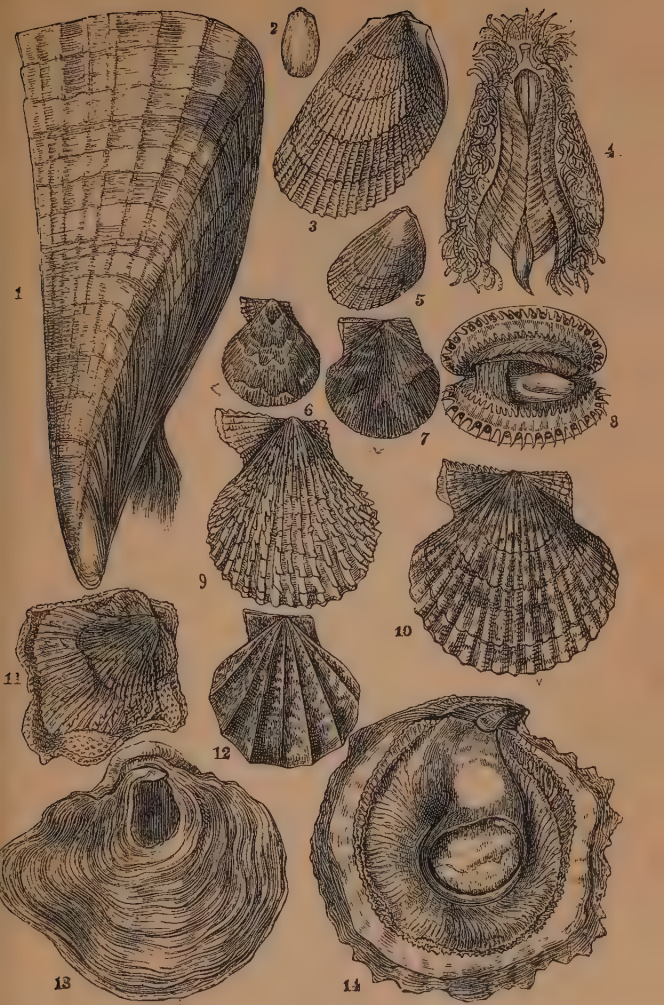

PLATE VI.

PLATE VII.

PLATE VIII.

PLATE IX.

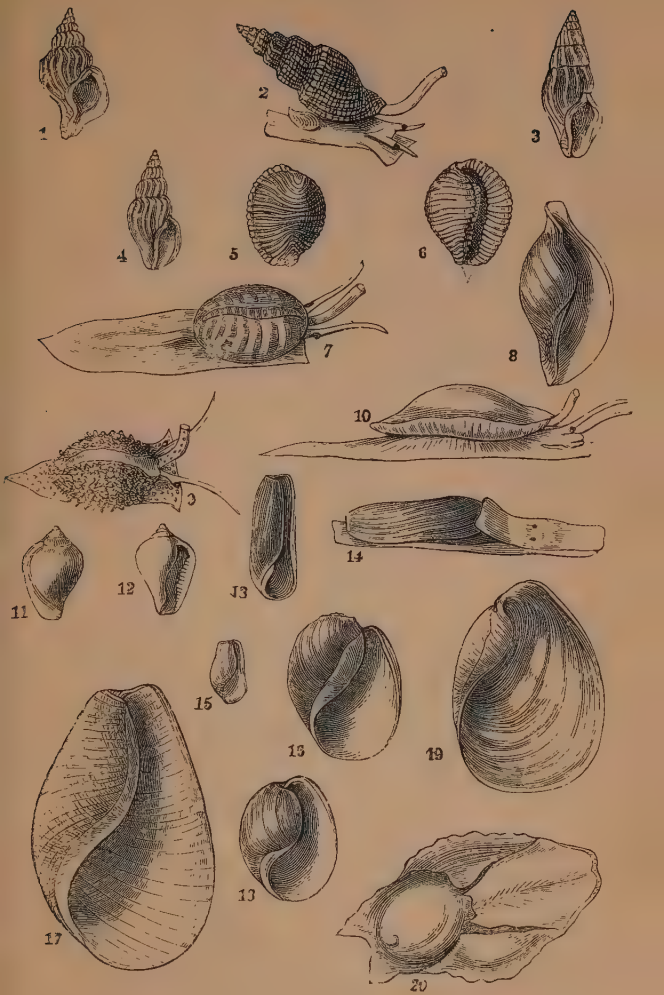

PLATE X.

PLATE XI.

PLATE XII.

Vaux
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LUKE
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